

AD-A276 591



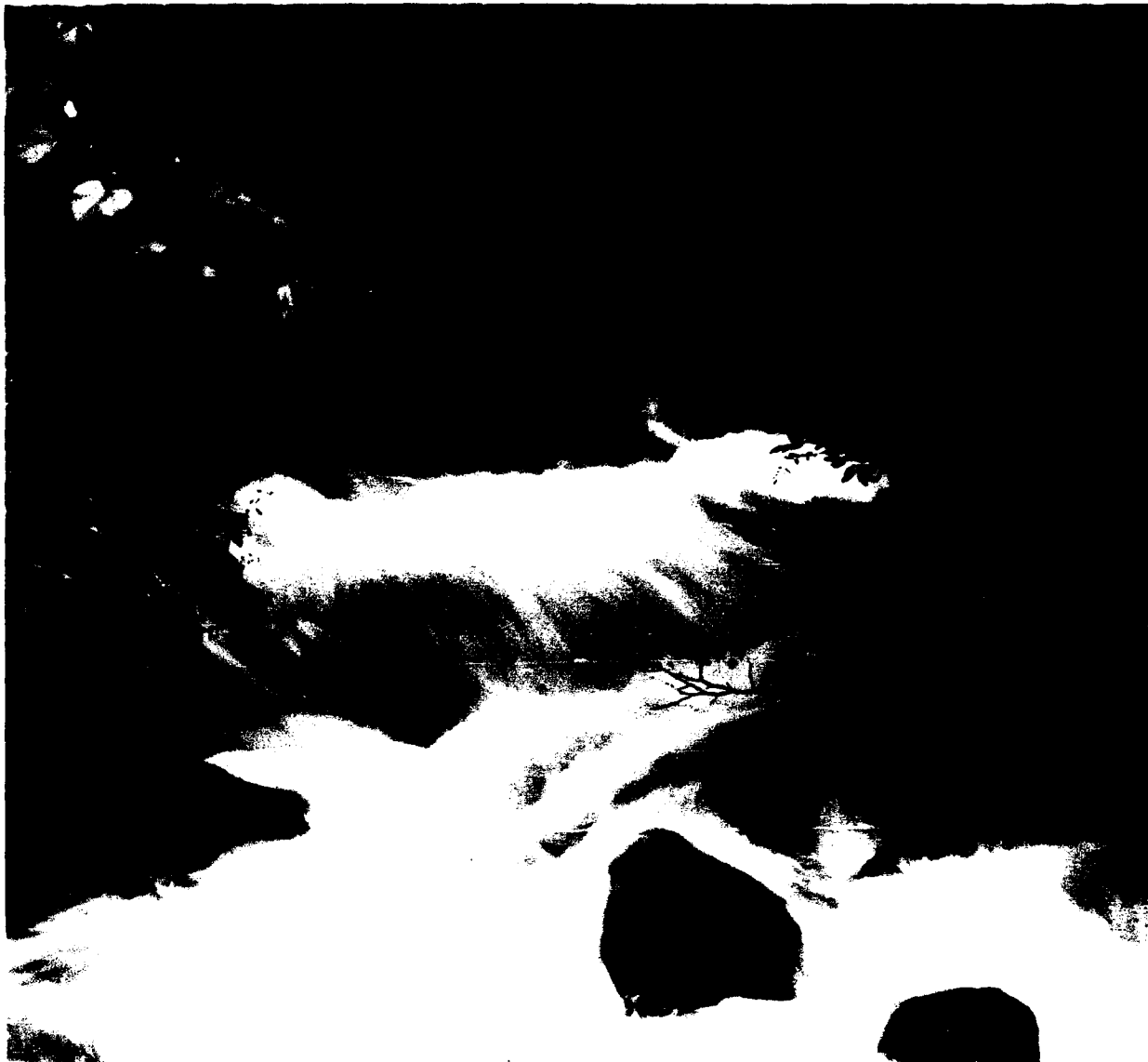
2

Logistics Management Institute

DTIC
SELECTE
MAR 8 1984
S D

Pollution Prevention in the Department of Defense

IR301R1



DISTRIBUTION STATEMENT A
Approved for public release
Distribution Unlimited

Andres Talts and Christopher P. Werle

LMI

8096 94-06786



94 3 01 01 2

Logistics Management Institute

Pollution Prevention in the Department of Defense

IR301R1

November 1993

Andres Talts
Christopher Werle

DTIC QUALITY INSPECTED 2

Prepared pursuant to Department of Defense Contract MDA903-90-C-0006. The views expressed here are those of the Logistics Management Institute at the time of issue but not necessarily those of the Department of Defense. Permission to quote or reproduce any part except for government purposes must be obtained from the Logistics Management Institute.

LOGISTICS MANAGEMENT INSTITUTE
6400 Goldsboro Road
Bethesda, MD 20817-5886

Preface

Prevention is the best long-term solution for reducing risks to human health and the environment from pollution. Enforcing pollution control standards and mandating the cleanup of contamination resulting from past practices are "end-of-the-pipe" solutions that will not eliminate risk as long as new sources of pollution are created. Pollution is prevented by eliminating requirements for hazardous materials, finding benign substitutes for those materials, recycling and reusing the materials, and treating them or converting them into benign substances before they are disposed of.

This report explores new approaches for establishing and promoting cost-effective pollution prevention programs within the Department of Defense. It provides an overview of pollution prevention programs currently under way across the DoD Components and in private industry. It highlights those initiatives holding the greatest promise for broad application within DoD. Most importantly, it recommends positive actions that will enable DoD to meet its environmental security objectives and affirm its national leadership role in pollution prevention.

This paper was prepared by the Logistics Management Institute as an independent research and development project. Under the internally funded IR&D program, we are able to analyze important program management issues, develop innovative procedures or tools, and focus attention on problems that may not yet have been funded by our Sponsors.

Accession For	
DTIC GRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

Pollution Prevention in the Department of Defense

Executive Summary

The Department of Defense is in a unique position to demonstrate national leadership in pollution prevention by taking positive actions in its acquisition programs for weapon systems and materiel. These actions should include implementing technologies and procedures for reducing waste from its current industrial processes, and by taking active measures during military training and routine base operating activities at its installations.

The highly successful hazardous waste minimization programs carried out by the Military Services and Defense agencies over the past several years have reduced hazardous waste generation by more than half. Similarly, nonhazardous-solid-waste management programs are well on the way to achieving significant reductions. Unfortunately, the high costs of efforts to sustain day-to-day compliance and cleanup of contamination have left little beyond "survival-level" resources available for pollution *prevention* initiatives, which ultimately have the greatest potential for future benefits.

We propose positive actions to further pollution prevention, as the method of choice for sustained environmental compliance and for the future direction of the overall DoD environmental program.

We provide detailed recommendations recognizing the need to continue several ongoing and effective DoD pollution prevention programs (i.e., those covering ozone-depleting substances, military standardization documents, etc.). In order to highlight new, time-sensitive initiatives, we recommend that:

- ◆ OSD quickly endorse Executive Order 12856, *Federal Compliance With Right-to-Know Laws and Pollution Prevention Requirements*, and call for support for it from the Military Services and from Defense agencies concerned with acquisition.
- ◆ OSD move to articulate a broadly defined pollution prevention strategy integrating the specific requirements of the new Executive order and the wide range of activities encompassed by the "plain English" meaning of the words "pollution prevention." The DoD strategy should embrace partnerships with the Environmental Protection Agency, the states, and the private sector (especially via such initiatives as the National Defense Center for Environmental Excellence).

- ◆ DoD leadership affirm support for pollution prevention by making appropriate remarks in various public forums and by endorsing "Model Installation" and "Model Acquisition" pollution prevention programs.
- ◆ The Defense Acquisition Board and its counterparts in the Services and other Components establish specific requirements for environmental documentation, including pollution prevention requirements, at each milestone review. We also recommend that DoD acquisition directives be amended to incorporate Design-for-the-Environment concepts and total-life-cycle environmental cost estimating procedures.
- ◆ DoD item managers undertake commodity-specific pollution prevention opportunity assessments for those items containing hazardous materials.
- ◆ Nonhazardous-solid-waste source reduction and recycling be integrated into pollution prevention requirements established for acquisition programs at DoD installations.
- ◆ DoD work with other Federal agencies and the Environmental Protection Agency to ensure the broadest and most effective use of the Pollution Prevention Information Center, Toxic Release Inventory, and other nationwide public systems for data collection, analysis, and information exchange.
- ◆ OSD undertake a study of the pros and cons of an environmental investment strategy that includes a centrally managed and centrally funded transfer account for pollution prevention initiatives.

We believe that by taking these actions, DoD will be in a position to meet its environmental security objectives and affirm its national leadership role in pollution prevention.

Contents

Preface	iii
Executive Summary	v
Figures	ix
Chapter 1. Introduction, Background, and Concepts	1-1
Introduction	1-1
Background	1-1
Concepts	1-5
Moving Forward	1-9
Chapter 2. Generic Examples of Pollution Prevention Activities in DoD	2-1
Pollution Prevention During the Manufacturing Process	2-1
Pollution Prevention in the Solid Waste Stream	2-3
Pollution Prevention in Land Management and Natural Resources Conservation	2-5
Chapter 3. Pollution Prevention Initiatives by Private Industry	3-1
General Observations	3-1
Industrywide programs	3-3
Design for the Environment	3-3
Companywide Programs	3-4
Voluntary Participation in EPA Programs	3-5
The Global Environmental Management Initiative	3-6
Chapter 4. Pollution Prevention Initiatives by the Military Services and the Defense Logistics Agency	4-1
Army	4-4
Navy	4-5
Marine Corps	4-8

Contents (Continued)

Air Force	4-8
Defense Logistics Agency	4-11
Summary and Future Direction	4-12
 Chapter 5. Pollution Prevention Opportunities for DoD	 5-1
Acquisition	5-1
Industrial Operations	5-5
Hazardous Materials	5-7
Data	5-8
Partnerships	5-10
Ozone-Depleting Substances (ODSs)	5-14
Solid Waste	5-14
Integrated Pollution Prevention Strategy	5-15
 Chapter 6. Recommendations	 6-1
 Appendix A. EPA Memorandum Defining Pollution Prevention	
 Appendix B. Executive Order 12856, Federal Compliance With Right-to-Know Laws and Pollution Prevention Requirements	
 Appendix C. Glossary	

Figures

1-1.	Waste Management Hierarchy	1-3
1-2.	Life Cycle of Manufactured Products	1-6
3-1.	Model for Successful Pollution Prevention Programs in Private Industry	3-2
4-1.	DoD Pollution Prevention Areas of Concern	4-2
4-2.	DoD Acquisition Process Phases and Milestones	4-3
4-3.	Army Materiel Command HAZMIN Industrial Waste Key Processes	4-6
4-4.	AFMC 1992 "EPA-17" Chemicals Baseline	4-10
4-5.	Life Cycle of DLA-Managed Hazardous Material	4-11
5-1.	Acquisition Life-Cycle Environmental Concerns	5-2
5-2.	Integrating Pollution Prevention into Acquisition Program Elements	5-3
5-3.	EPA Method for Estimating Pollution Prevention Life-Cycle Costs	5-4
5-4.	TRI Process	5-11
5-5.	NDCEE Pollution Prevention Functions	5-12

"An ounce of prevention is worth a pound of cure." — Benjamin Franklin

CHAPTER 1

Introduction, Background, and Concepts

INTRODUCTION

There are significant opportunities for industry to reduce or *prevent pollution* at the source through cost-effective changes in production, operation, and raw materials use. Such changes will offer industry substantial savings in reduced raw material, pollution control, and liability costs as well as help protect the environment and reduce risks to worker health and safety¹ (emphasis added).

The preceding excerpt from the Pollution Prevention Act (PPA) of 1990 also serves as a guiding principle for pollution prevention programs for DoD's Military Services and Defense agencies.

BACKGROUND

Environmental laws may be generally categorized either as rule-based or as planning laws. Rule-based environmental laws result in regulations that are prescriptive in nature, and they typically mandate inspections, permits, monitoring and reporting, and enforcement activities by Federal and state regulatory agencies. The Clean Air Act (CAA), the Clean Water Act (CWA), and the Resource Conservation and Recovery Act (RCRA) now "command and control" these activities for DoD facilities in much the same way as they do for the private sector. These are the so-called "pollution control" types of laws. The Federal Facilities Compliance Act of 1992 (FFCA), for example, removed the last vestiges of Federal sovereign immunity from the application of RCRA hazardous waste requirements to DoD facilities.

These pollution control laws are in contrast to the planning type of environmental laws, such as the National Environmental Policy Act (NEPA), the Endangered Species Act, the National Historic Preservation Act, and the Forest Management Act. These entail public involvement, consultation with Federal and state agencies, and negotiations.

¹ Pollution Prevention Act of 1990, 42 U.S.C. 13101 et seq.

The comparison of rule-based versus planning types of environmental laws suggests a basis for increased DoD emphasis on a pollution prevention strategy. The long-term potential for success of a pollution prevention strategy as opposed to that of a pollution control approach is intuitively obvious and is supported by many examples. Pollution control strategies have achieved notable reductions in emissions, but the incremental gains in environmental quality are unfortunately counteracted by increased growth in public, commercial, and industrial activities. Conversely, a strategy of pollution prevention that changes the technology of production (i.e., source control) eliminates the pollutant.

The emissions of air pollutants from automobiles serve as an excellent illustration at the macro level. In the past several decades the automobile has come to be recognized as the source of several major air pollutants: carbon monoxide, nitrogen oxides, and lead. The Environmental Protection Agency (EPA) rule-making prescribed specific control devices and predicted reductions of 80 and 70 percent, respectively, for carbon monoxide and nitrogen oxides. Unfortunately, during one decade the reduction achieved was only 19 percent for carbon monoxide, while a gain of 2 percent was noted for nitrogen oxide emissions. The increase in automobile fuel consumption overwhelmed the control technologies. Meanwhile, lead, which was widely used in gasoline as an octane booster, was found to poison catalytic converters and was thus eliminated as a gasoline additive. As a result, airborne lead emissions have declined by over 90 percent over the last two decades. A pollution prevention strategy for eliminating carbon monoxide and nitrogen oxides from automobile emissions indicates a change-the-engine or change-the-fuel type of approach, and the trends toward electric cars in cities suggest movement in this direction.

The NEPA established prevention of environmental degradation as a U.S. national policy in 1970. The environmental policy for reducing waste generation was somewhat "rediscovered" between 1986 and 1989 during the national debates over amendments to the RCRA, the CAA, and the CWA. This period included the reauthorization of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) [specifically, the Superfund Amendments and Reauthorization Act (SARA)] of 1986, Title III — also known as the Emergency Planning and Community Right-to-Know Act (EPCRA). The PPA of 1990 was the device that focused attention on the "new" national policy to prevent pollution at the source rather than merely control the emission of pollutants at "the end of the pipe."

It is noteworthy that in the PPA, Congress did not define pollution prevention per se but laid out a national policy for waste management — a waste management hierarchy — and directed the EPA to establish a source reduction program linked to the SARA/EPCRA requirements for hazardous and toxic chemicals.

The Congress hereby declares it to be the national policy of the United States that pollution should be prevented or *reduced at the source* whenever feasible; pollution that cannot be prevented should be *recycled* in an environmentally safe manner, whenever feasible; pollution that cannot be prevented or recycled should be *treated* in an environmentally safe manner whenever feasible; and *disposal* or other release into the

environment should be employed only as a last resort and should be conducted in an environmentally safe manner² (emphasis added).

This hierarchy is depicted in Figure 1-1.

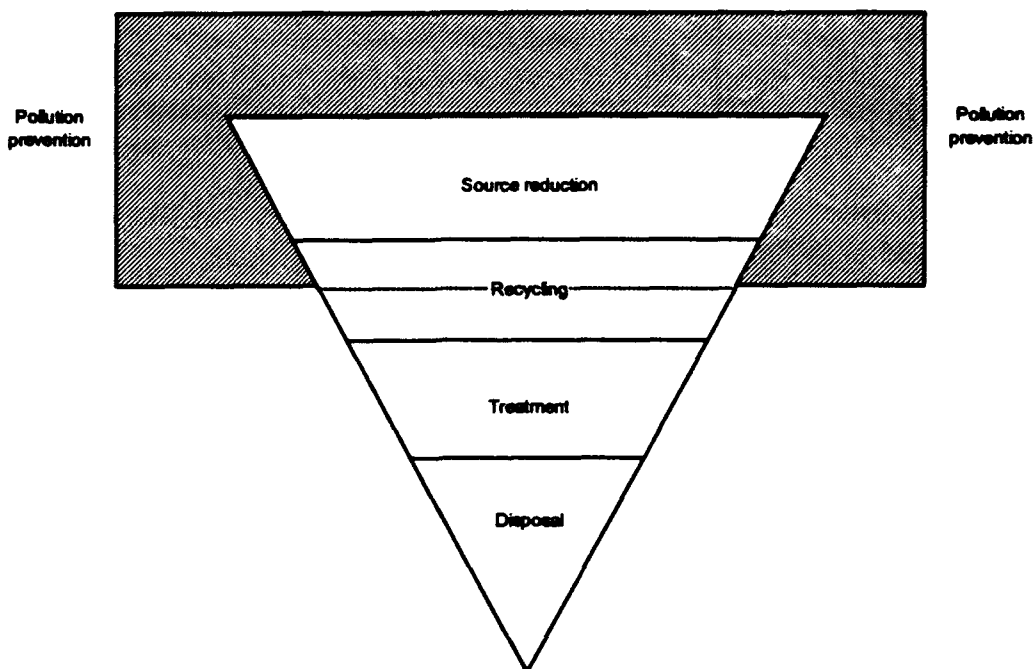


Figure 1-1.
Waste Management Hierarchy

The Act goes on to define "source reduction" as follows:

(5) (A) The term "source reduction" means any practice which: (i) reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and (ii) reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants.

The term includes equipment or technology modifications, process or procedure modifications, reformation or redesign of products, substitution of raw materials, and improvements in housekeeping, maintenance, training, or inventory control.

(B) The term "source reduction" does not include any practice which alters the physical, chemical, or biological characteristics or the volume of a hazardous substance, pollutant, or contaminant through a process or activity which itself is not integral to and necessary for the production of a product or the providing of a service.

The PPA required the EPA to establish a pollution prevention office and to implement a multimedia approach to a source-reduction strategy. The Act also required owners or operators of facilities subject to SARA/EPCRA to file a toxic

² Ibid.

chemical source reduction and recycling report for each calendar year, linked to the toxic chemicals required to be reported under SARA/EPCRA.

The EPA went on to define pollution prevention in 1992 in a manner consistent with the PPA definition of source reduction, as follows (memorandum attached as Appendix A):

Pollution prevention means "source reduction," as defined under the Pollution Prevention Act, and other practices that reduce or eliminate the creation of pollutants through: — increased efficiency in the use of raw materials, energy, water, or other resources, or — protection of natural resources by conservation.³

The EPA affirmed that *recycling, energy recovery, treatment, and disposal are not included within the definition of pollution prevention*. Some practices commonly described as *"in-process recycling"* may qualify as pollution prevention. Also, the EPA points out that pollution prevention approaches can be applied to all pollution-generating activities, including those found in the energy, agriculture, Federal, consumer, and industrial sectors.

The President's Earth Day - 1993⁴ speech set the stage for Executive Order (EO) 12856⁵ (Appendix B) to Federal agencies specifically requiring *full compliance with EPCRA and the PPA*. EO 12856 also defined pollution prevention in the same way as the EPA defined it above. Federal agencies are required to comply fully with the *public involvement* provisions and with the *toxic inventory and reporting* provisions of EPCRA to the same extent as private-sector industries. Also, Federal agencies must develop *pollution prevention strategies, programs, and plans* that include a commitment to incorporate pollution prevention through *source reduction in facility management and in acquisition*.

Further, Federal agencies are committed to utilize pollution prevention through source reduction where practicable as the primary means for achieving compliance with all environmental requirements. Goals are established to reduce releases of toxic pollution into the environment and to cut off-site transfers of such chemicals for treatment and disposal by 50 percent before 31 December 1999 (using 1994 as the baseline year) — and such reductions are to be achieved by implementing source reduction practices to the maximum extent practicable. Federal agencies will also have to identify opportunities and make provisions for reducing or eliminating toxic chemicals and hazardous substances from their standardization documents (specifications, standards).

³U.S. EPA, Memorandum of 28 May 1992, Subject: *EPA Definition of "Pollution Prevention."*

⁴Remarks by President Clinton, Earth Day Speech, U.S. Botanical Gardens, Washington, DC, 21 April 1993.

⁵*Federal Compliance With Right-to-Know Laws and Pollution Prevention Requirements*, 3 August 1993.

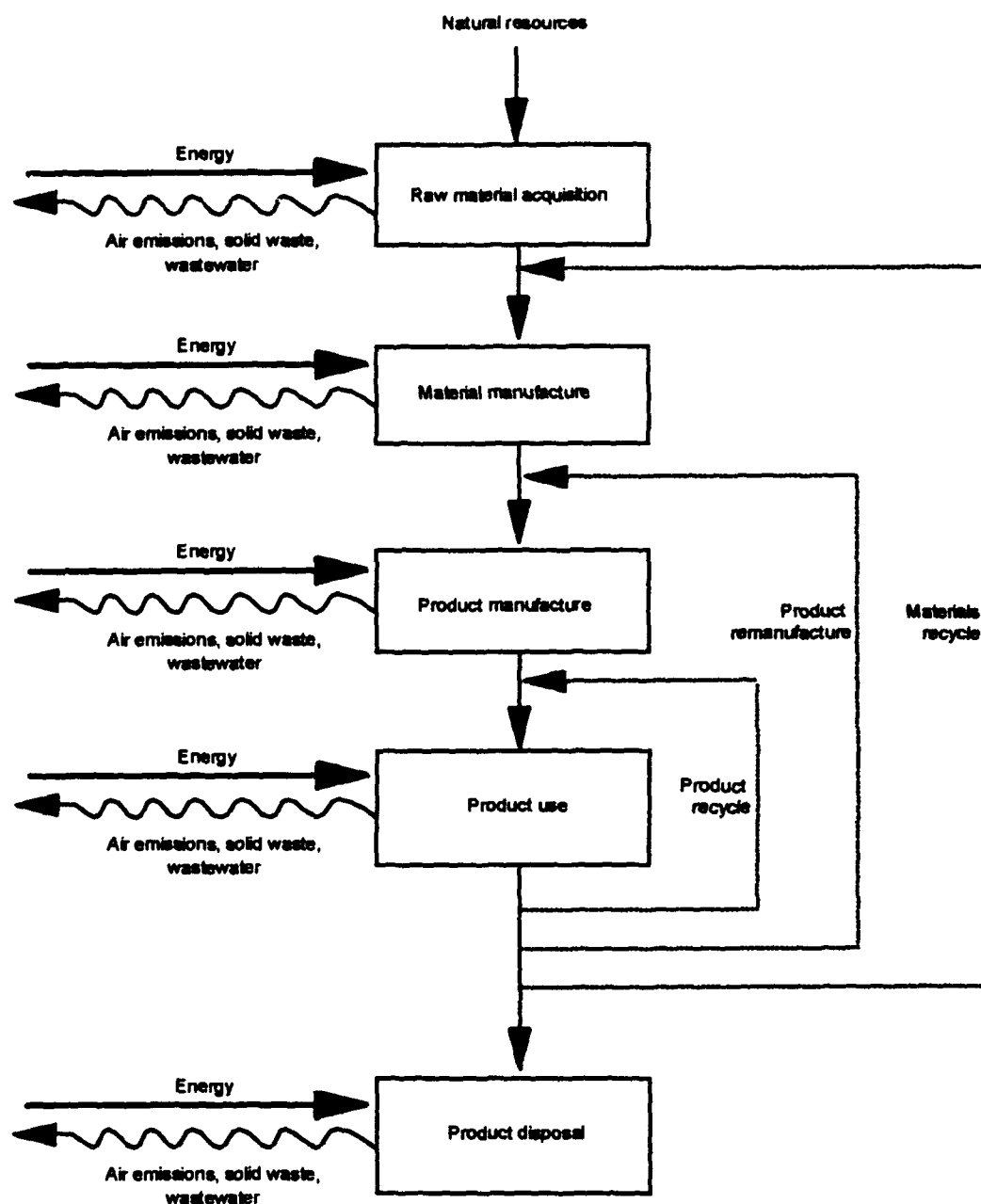
CONCEPTS

Public and congressional debates on hazardous and toxic waste management issues have fostered a shift in national environmental policy from pollution control to pollution prevention. Waste minimization requirements associated with the Hazardous and Solid Waste Amendments to RCRA in 1986 and the toxic inventory and public reporting aspects of EPCRA were also evolving concurrently. EPA national environmental policy statements in 1989 asserted this shift in environmental policy emphasis from pollution control to a prevention program to reduce or eliminate the generation of potentially harmful pollutants.

However, amid the general agreement of policy there arose a confusion of terms, definitions — pollution prevention, source reduction, waste reduction, recycling — and applications. The plain English meaning of the words “pollution prevention” has been influenced and shaped to fit particular needs to describe policies and programs. Thus, pollution prevention has become synonymous with waste reduction and has focused primarily on hazardous wastes and toxic substances. The “official” definitions, discussed earlier, although linked to waste source reduction, are still rather broad in terms of multimedia/substance/waste. The Tidewater Interagency Pollution Prevention Program (TIPPP), for example, has programmatically defined pollution prevention as “any action that reduces the impact that an activity may have on the environment (including impacts to the air, surface waters, ground waters, and soils) through reduction (or elimination) of wastes, more efficient use of raw materials or energy, and/or reduced emissions of toxic materials to the environment.” This definition seems to include pollution prevention actions at all levels of the waste management hierarchy postulated by the PPA.

In the private sector, the emphasis has been on the manufacturing industries, as conceptualized in Figure 1-2 on the life cycle of manufactured products.

Some degree of pollution is going to be generated at each phase in the life cycle of any manufactured product or industrial operation. Pollution prevention activities involve changing manufacturing and other industrial processes that are almost infinitely variable and complex. Thus, attempting to precisely define these terms is at best difficult, and succinct definitions are open to broad interpretations.



Source: Society of Environmental Technology and Chemistry (SETAC), "A Technical Framework for Life Cycle Assessments," as referenced in "Course Notes: Pollution Prevention Workshop," UCLA, Santa Monica, Cal., 28 June - 1 July 1993.

Figure 1-2.
Life Cycle of Manufactured Products

In 1987, the Office of Technology Assessment limited the term "pollution prevention" to

in-plant practices that reduce, avoid, or eliminate the generation of hazardous waste so as to reduce risks to health and the environment. Actions taken away from the waste generating activity, including waste recycling or treatment of wastes after they are generated, are not considered waste reduction (**pollution prevention**). Also, an action that merely concentrates the hazardous content of a waste to reduce degree of hazard is not considered waste reduction (**pollution prevention**). This definition is meant to be consistent with the goal of preventing the generation of waste at its source rather than controlling, treating or managing waste after its generation (parenthetical emphasis added).

The programmatic, narrowly constructed definition leads to a concept of "direct" pollution prevention by source reduction, vice "indirect" pollution prevention, more or less consistent with the plain English meaning of the words as applied throughout the waste management hierarchy. This notion is applied to selected DoD functional areas in Table 1-1.

Source reduction clearly meets anyone's definition of pollution prevention, since there is a direct reduction of pollution and risk resulting from changes in processes, products, or product manufacturing technology. Similarly, in-process recycling prevents pollution and reduces risk by conserving resources and energy during the material manufacturing phase. Wastes associated with manufacture are thereby proportionately reduced as well.

Recycling indirectly prevents pollution and reduces risk by

- ◆ Reducing our reliance on landfills and incinerators (and thus reducing the wastes those activities generate)
- ◆ Saving the energy needed to manufacture a product (when either products or materials are recycled)
- ◆ Protecting human health and the environment by removing harmful substances from the waste stream and thereby preventing further contamination
- ◆ Conserving natural resources (when materials are recycled), thereby saving the energy needed to produce raw materials.

Treatment indirectly prevents additional pollution or environmental contamination and reduces risk (beyond that generated during production) by effectively neutralizing waste or otherwise rendering it harmless to human health and the environment before its disposal or release. In some cases, such as when waste oil is burned to power a steam boiler, treatment can even be used to recover energy initially lost in the production process. However, waste treatment, even in its broadest meaning, generally falls outside the legislative (and the EPA's) definition of pollution prevention.

Table 1-1.
Direct vs. Indirect Pollution Prevention Across DoD
Functional Areas

		Source reduction	Recycling	Treatment	Disposal
Acquisition Programs	Concept Exploration	PP PP PP pp	PP PP PP pp	PP pp pp pp	PP pp pp pp
	Demonstration & Validation	PP PP PP pp	PP PP PP pp	PP pp pp pp	PP PP pp pp
	Engineering & Mfg. Development	PP PP PP pp	PP PP PP pp	PP pp pp pp	PP pp pp pp
	Production & Deployment	PP PP pp pp	PP pp pp pp	pp pp pp pp	pp pp pp pp
	Operations & Support	PP pp pp pp	PP pp pp pp	pp pp pp pp	pp pp pp pp
Military Missions	Operational Training	PP pp pp pp	pp pp pp pp	pp pp pp pp	pp pp pp pp
	"Schoolhouse" Training	PP pp pp pp	pp pp pp pp	pp pp pp pp	pp pp pp pp
Logistics Support	Supply	PP pp pp pp	PP pp pp pp	pp pp pp pp	pp pp pp pp
	Maintenance	PP PP pp pp	PP pp pp pp	pp pp pp pp	pp pp pp pp
	Transportation	pp pp pp pp	pp pp pp pp	pp pp pp pp	pp pp pp pp
Base Operations Support	Forts, Bases, Posts, Stations	PP pp pp pp	pp pp pp pp	pp pp pp pp	pp pp pp pp
	Industrial Facilities	PP PP PP pp	PP pp pp pp	pp pp pp pp	pp pp pp pp

Note: Mfg. = manufacturing; PP = direct pollution prevention as defined by EO 12856; pp = indirect pollution in the plain English meaning of the words.

Disposal likewise indirectly prevents additional pollution or environmental contamination and reduces risk (when it is accomplished in an environmentally sound manner) by containing waste and precluding its migration outside the disposal site for the balance of the time it remains potentially harmful to the environment. Disposal also generally falls outside the accepted definition of pollution prevention.

The legislative definition of "source reduction" in the PPA, and the embodiment of the "source reduction" conceptual definition of pollution prevention by the EPA and in EO 12856, provide an adequate framework to allow the Military Services and other DoD Components to proceed with their strategies, programs, and plans.

To demonstrate leadership, the DoD environmental security program should, however, embrace the broader concepts of pollution prevention and also deal with the narrower constructs of pollution prevention requirements imposed by EO 12856. The DoD strategy for pollution prevention should include any action that directly or indirectly reduces the adverse impacts and associated risks that an individual, operation, or activity may have on the environment (including impacts to the air, surface waters, ground waters, or soils) through the reduction or elimination of potentially harmful substances, more efficient use of raw materials or energy, and/or impartation of an increased awareness for and practice of sound environmental ethics.

We note that DoD Directive 4210.15,⁶ which provides excellent policy guidance on hazardous materials pollution prevention, must be updated to accommodate these changes.

It is not useful to debate these terms further at a national level. However, the proliferation of many and differing state-level definitions of them is resulting in the situation now existent for applicability of environmental laws at DoD facilities — that is, DoD facilities will have to comply with many overlapping and sometimes conflicting laws and regulations, and differences will have to be resolved on a case-by-case basis.

MOVING FORWARD

The Military Services and other DoD Components have achieved remarkable successes in hazardous waste minimization (HAZMIN) programs over the past several years. The focus has been on reducing the generation and disposal of hazardous waste, and the successes have largely been achieved through process modifications, changes in "housekeeping" methods, the adoption of intensive waste management (and waste segregation) practices, and improvements in recycling, treatment, and disposal. While pollution prevention efforts (within the source-reduction meaning of the term) have contributed to these reductions, opportunities for major waste minimization still face institutional barriers to change and technical constraints imposed (in part) by military-unique requirements.

The implications of these shifts in national environmental policy are significant for DoD environmental programs. DoD needs to respond with a fundamental shift from emphasis on high-priority/high-cost compliance and cleanup programs to a culture change that embraces pollution prevention and conservation as an integral part of the Defense national security mission. This fact has been recognized by OSD and the Services;⁷ the changes can be seen in the latest policy pronouncements and trend shifts, which will be discussed in subsequent chapters.

⁶ *Hazardous Material Pollution Prevention*, 27 July 1989.

⁷ With particular reference to the testimony by the environmental leadership within OSD and the Military Services before the Senate Armed Services Committee, Subcommittee on Military Readiness and Defense Infrastructure, Washington, D.C., 9 June 1993.

CHAPTER 2

Generic Examples of Pollution Prevention Activities in DoD

Given the evolution of pollution prevention concepts in parallel with HAZMIN initiatives within OSD and the Military Services, it is generally easier to understand terms if specific examples of what is being described are given. For instance, one might not immediately be certain of the meaning of "environmentally friendly product" when no additional information is presented. However, once examples such as reusable/recyclable containers, biodegradable detergents, rechargeable batteries, and nontoxic cleaners are provided, the meaning becomes clear.

To better understand pollution prevention as it has been legislatively and programmatically defined above, it would also be helpful to review a detailed list of illustrative examples. To facilitate this review, examples can be categorized by area where pollution is generated, or where environmental degradation most often occurs. Accordingly, we will focus on methods for preventing pollution during the manufacturing process, when solid waste is generated, and in land management and resource conservation.

The categories and examples described are based in large part on the Army Environmental Policy Institute's *Pollution Prevention: National Trends, Forecasts, and Options for the Army*, 26 June 1992.

POLLUTION PREVENTION DURING THE MANUFACTURING PROCESS

Here it is easiest to follow the hierarchy presented in Chapter 1: source reduction, recycling, treatment, and disposal.

- ◆ *Source reduction* during the manufacturing process examines the volume and toxicity of the wastes generated, in order to devise ways to reduce or eliminate them. Specific examples include the following:
 - ▶ Waste stream analysis/process modification — determining where and why wastes are generated during manufacturing processes and modifying or redesigning processes to reduce or eliminate them.
 - ▶ Substitution — using nonhazardous or nontoxic materials as feedstock instead of hazardous or toxic ones during the production process.

- ▶ Increasing the efficiency of machinery — greater efficiency during processing usually results in less waste at the end of the process.
 - ▶ Waste segregation — keeping hazardous and nonhazardous wastes separate to reduce the total amount that must be treated and/or disposed of as hazardous waste.
 - ▶ Materials management — procuring and stocking only those materials of the highest possible purity that can be effectively used within their shelf life.
 - ▶ Improved housekeeping — streamlining overall operations to eliminate careless or wasteful practices.
 - ▶ Training — providing initial, update, and refresher courses to ensure proper equipment operation and maintenance.
- ◆ *Recycling during the manufacturing process (i.e., in-process recycling) and other activities that eliminate the creation of pollutants by increased efficiency in the use of raw materials, energy, water, or other resources or by protection of natural resources by conservation (and which are integral to and necessary for the production of a product or the providing of a service) may be considered under the pollution prevention definition. If the recycling includes a waste treatment that alters the physical, chemical, or biological characteristics of a waste (and is not integral to and necessary for the manufacturing process), then such recycling would not be considered pollution prevention. Specific examples of recycling (and/or reuse) under the definition of pollution prevention include the following:*
- ▶ Cleaning and reloading spent ammunition cartridge cases to save the energy and raw materials needed to produce brass and to manufacture the brass cases themselves.
 - ▶ Overhauling vehicle engines and rebuilding major engine components rather than manufacturing new ones from basic materials.
 - ▶ Reconditioning 55-gallon drums or other containers and using them again for storing various substances rather than manufacturing new ones from basic materials.
 - ▶ Re-refining spent oil, solvents, antifreeze, etc., and then using them as process stock materials.
 - ▶ Melting down metal components that can no longer be reconditioned and using the basic materials to manufacture new ones.

- ▶ Processing wastepaper into pulp and using it to manufacture new paper rather than using virgin materials.
- ▶ Melting down waste plastics and using them to make benches, parking lot curbing, or some other plastic item.
- ◆ *Treatment and disposal* are generally outside the definition of pollution prevention but are an integral part of the waste management hierarchy and must be afforded appropriate consideration in a pollution prevention strategy. *Treatment* recognizes that some products and/or wastes cannot be re-used or recycled and will ultimately have to be disposed of. *Treatment*, by reducing the waste to simple, benign materials ensures that the environment will not be degraded once the item or substance has been discarded, whereas *disposal* simply captures the waste in a secure facility. Specific treatment examples that deserve attention but are *not considered* to fall under the definition of *pollution prevention* include the following:
 - ▶ Neutralizing waste acid prior to release to a municipal wastewater treatment plant for further treatment.
 - ▶ Removing toxic heavy metals from process wastewater by cycling them through ion exchange units prior to disposal.
 - ▶ Biologically treating contaminated soil prior to disposal to reduce toxicity to levels at or below those established as acceptable risk.
- ◆ *Disposal* during the manufacturing process means just what the word implies. What is important is that disposal be accomplished in an environmentally sound manner so that further degradation does not occur. Specific examples of concepts to be embraced within a comprehensive waste management hierarchy, but outside of the definition of pollution prevention, include the following:
 - ▶ Placing hazardous wastes in an RCRA-approved and -permitted landfill or thermally destroying them in a permitted incinerator.
 - ▶ Implementing improved monitoring programs to ensure that wastes do not migrate and cause additional pollution for the duration of the time they remain potentially harmful.

POLLUTION PREVENTION IN THE SOLID WASTE STREAM

Solid waste generally means municipal waste (i.e., trash or garbage). The most effective way to prevent pollution in this area is once again to follow the hierarchy, with emphasis on source reduction, reuse, recycling, and, as the EPA terms it, responding to the solid waste dilemma by reconsidering waste-

producing activities and expressing a preference for less waste. Specific examples include the following:

- ◆ Reducing the amount of unnecessary packaging found on products. (This includes such actions as purchasing items in bulk from loose bins, buying large/economy-sized items that have less packaging per unit of product, buying concentrated products, and purchasing only what you need.)
- ◆ Adopting practices that reduce waste volume and toxicity. (This includes using nonhazardous or less hazardous substances whenever possible, using physical rather than chemical means for accomplishing a task, using hazardous materials sparingly when there are no alternatives, recycling hazardous wastes and materials to keep them out of the waste stream, and giving excess materials to other groups or agencies for their use rather than disposing of them.)
- ◆ Purchasing and using reusable products and containers. (This includes using such things as sturdy, washable commodities, rechargeable batteries, and refillable items; using items designed for one purpose for other, innovative purposes; and being careful to order only the amount of single-use items needed.)
- ◆ Maintaining and repairing durable products. (This includes such matters as purchasing high-quality, long-lasting equipment with superior warranties; keeping items in a good state of repair by following recommendations for proper operation and maintenance; repairing items instead of disposing of them; and using low-energy fluorescent light bulbs rather than incandescent ones.)
- ◆ Borrowing, renting, or sharing items that are used only occasionally, such as power tools, special equipment, newspapers, magazines, etc.
- ◆ Selling or donating goods instead of disposing of them.
- ◆ Purchasing recyclable products and containers and then recycling them.
- ◆ Purchasing products made from recycled materials.
- ◆ Composting items such as yard and food waste.
- ◆ Educating others on pollution prevention practices such as source reduction and recycling.
- ◆ Encouraging creativity in finding new ways to reduce waste volume and toxicity.

POLLUTION PREVENTION IN LAND MANAGEMENT AND NATURAL RESOURCES CONSERVATION

Generally speaking, this section deals with developing and implementing programs and plans to maintain and improve environmental quality, aesthetic values, and ecological relationships. This topic incorporates the land and water areas DoD manages as well as the raw materials, vegetation, and wildlife associated with them. It also includes energy management. It is very broad in perspective and relative meaning. In its 1992 report *Pollution Prevention: National Trends, Forecasts and Options for the Army*, the Army Environmental Policy Institute describes some pollution prevention techniques applying to land and natural resources management activities:

- ◆ Minimizing disruption of natural hydrology, protecting natural plant life, and retaining natural drainage ways during construction (or demolition) of facilities, buildings, and roads.
- ◆ Protecting woodlands and riparian areas vital to the survival of rivers, lakes, bays, estuaries, and their indigenous wildlife (woodlands/riparian area protection).
- ◆ Considering the "carrying capacity" (i.e., the capability of the land to support mission activities) of areas under management in planning for land development such as construction of new buildings and roads (master planning).
- ◆ Minimizing pesticide and herbicide use to reduce impacts on aquatic systems, on plants, and on animals (pesticide/herbicide management).
- ◆ Planning, designing, and operating logging/silviculture programs to minimize erosion, pesticide use, and hydrologic disruption to streams, woodlands, and surface waters (forestry management).
- ◆ Planning so as to ensure that operations do not have an adverse impact on cultural, historic, and/or archaeological sites.
- ◆ Managing wildlife, including endangered species, to preserve the natural balance and prevent degradation from activities such as overpopulation.
- ◆ Addressing multinational issues (such as global warming) and using safe substitutes for ozone-depleting substances (ODSs).
- ◆ Promoting more efficient energy use (such as using fluorescent instead of incandescent lighting) and using substitutes for fossil fuels.
- ◆ Promoting and using recycling as a means of reducing the demand for raw materials, thereby conserving the natural resource base.

Many more examples could be used to illustrate the various pollution prevention categories, but the preceding lists should help one to visualize how pollution prevention translates into daily operational activities.

The following chapters will look at the major pollution prevention initiatives under way in private industry and in the DoD Components, focusing on areas of opportunity with the greatest promise for application throughout the Department.

CHAPTER 3

Pollution Prevention Initiatives by Private Industry

The first chapter discussed the increasing national focus on environmental issues and the resulting shift from pollution control to a pollution prevention national ideology. Collectively, DoD and private-sector industrial activities and operations represent the largest potential element of environmental risk. They also represent the largest base from which the benefits of pollution prevention can best be realized.

Recognizing that establishing sound pollution prevention programs is a win-win proposition, DoD Components and the private sector have undertaken many initiatives. A 1991 EPA report¹ provided an overview of these initiatives. That report serves as the source for most of the information presented here.

The EPA's philosophy as outlined in the publication focuses on the entities playing key roles in preventive pollution. The key players are identified as industry, the Federal Government (including DoD), state governments, county and municipal governments, public interest groups, environmental organizations, academia, and finally, each of us as individuals.

This chapter describes in broad terms the major thrusts by industry. It also presents information on critical EPA initiatives that have been undertaken in close coordination with this key element of the regulated community. It will serve as the basis for later discussions of those initiatives holding the greatest promise for initial or expanded application in DoD.

GENERAL OBSERVATIONS

The EPA in 1992 issued an update to its facility pollution prevention guide, describing in considerable detail how to establish a pollution prevention program in a private manufacturing company.² This excellent document also has direct applicability to many DoD installations, especially industrial facilities. However, in private-sector industries there is little consensus concerning the definitions of pollution prevention terms, and approaches range from narrow-scope product or process modifications to holistic corporate total quality management (TQM) concepts and programs for risk reduction, economic loss control, liability reduction, etc. The competitive advantages of pollution prevention have

¹U.S. EPA, *Pollution Prevention 1991 – Progress on Reducing Industrial Pollutants*, Report No. 21P-3003, October 1991.

²U.S. EPA, *Facility Pollution Prevention Guide*, EPA/600/R-92/088, May 1992.

been widely recognized and articulated. To the extent that it is possible to generalize about this situation, it can be said that successful pollution prevention programs involve some form of the process illustrated in Figure 3-1.

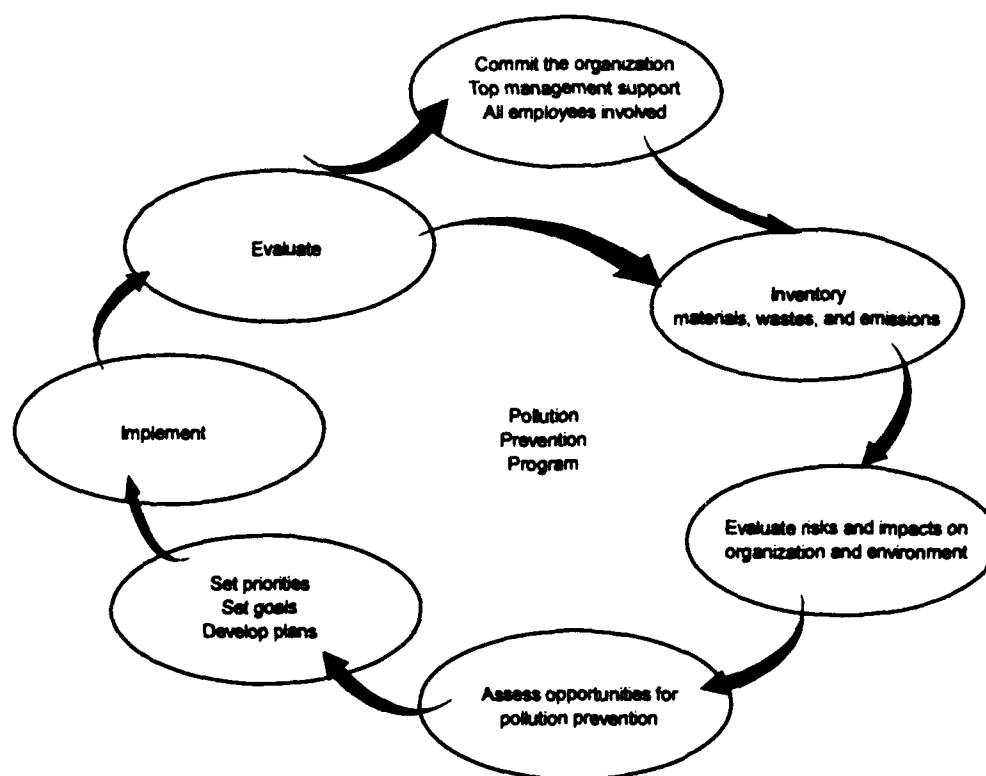


Figure 3-1.
Model for Successful Pollution Prevention Programs in Private Industry

In this framework, pollution prevention is comparable to the concepts of TQM. *Committing the organization* must first be accomplished, to align both management and the workforce according to the desired direction and outcomes. Next, an *inventory of materials, wastes, and emissions* is accomplished to establish a baseline and define the magnitude of the problem. The *risks and impacts* of wastes and emissions are then evaluated as they relate to both the organization's effectiveness and the environment. Once *opportunities* for pollution prevention are assessed, then *priorities, goals, and plans* are developed and *implemented*. Progress in achieving goals is continually *evaluated*, and the cycle is repeated and refined until all objectives have been met.

INDUSTRYWIDE PROGRAMS

Industrywide initiatives have been centered on four trade associations representing industries that have undertaken pollution prevention programs. These associations are the Chemical Manufacturers Association (CMA), the American Petroleum Institute (API), the National Paint and Coatings Association (NPCA), and the National Electrical Manufacturers Association (NEMA).

The basic thrust here has been on fostering an environmental ethic throughout the industry. This is accomplished by (1) establishing "guiding principles" or policy statements to which all member organizations pledge to subscribe and (2) providing educational workshops and/or technical assistance to members in the area of pollution prevention.

To illustrate the former, API has prescribed 11 guiding principles that its members must follow. Generally speaking, the principles address actions needed to protect human health, safety, and the environment. One specific principle directly addresses pollution prevention by requiring its members to "commit to reduce overall emissions and waste generation."³

As an example of the latter, NEMA conducted an educational workshop providing members information on successful pollution prevention programs by discussing various case studies. NEMA also offers technical assistance to its members by having corporate leaders share information with member companies on specific methodologies for preventing pollution. Two areas recently addressed in this manner are techniques for reducing air emissions and off-site transfers of waste.

The EPA points out that these association initiatives are relatively new and that it may take some time to determine their impact across industry. There is optimism, however, that positive results will be obtained.

DESIGN FOR THE ENVIRONMENT

The Design for the Environment (DfE) concept originated with the electronics industry and has been championed by the EPA for industrywide application. As the name implies, the pollution prevention emphasis is placed on the design phase of the product or process. The DfE concept, as articulated by the EPA, affords a framework for designers to take into account environmental concerns and minimize impacts and risks prior to manufacturing and operation. The EPA's *Facility Pollution Prevention Guide*, cited above, gives additional guidance.

³Chevron Corporation, 1990 *Report on the Environment: A Commitment to Excellence*, p. 27.

The EPA DfE program focuses on the design stages of chemical process and product development. The EPA Cleaner Technology Substitutes Assessment system provides an analytical tool for transferring concepts from theory to practice. An EPA data base to support the Cleaner Technologies Reporting Program will lead to an inventory of substitute assessments.

COMPANYWIDE PROGRAMS

Company programs have developed primarily within the manufacturing sector; they vary significantly. These programs tend to be of either a single or multimedia nature and may focus on one or more priority pollutants. Generally speaking, they reflect adherence to the waste management hierarchy of source reduction, recycling, treatment, and disposal outlined in the first chapter.

Common features of most programs include a statement of either a broad or specific program goal that sets targets such as the environmental medium to be addressed, the type and amount of pollutant to be reduced, and the deadline by which the reduction will occur.

One notable example is Dow Chemical's Waste Reduction Always Pays (WRAP) program, initiated in 1986, which focuses on source reduction and on-site recycling activities to achieve the desired outcome. Specific WRAP goals include increasing management support for waste reduction activities, establishing recognition and reward systems, compiling waste reduction data and communicating results achieved, decreasing SARA 313 air emissions 50 percent by 1995 (using a 1988 base), and decreasing all toxic air emissions 71 percent by December 1992 (using a December 1988 base).

Initial results obtained through the WRAP program include a 21 percent reduction in overall SARA 313 releases in 1989 (9,659 tons) as compared to 1987 (12,252 tons). Off-site transfers were also down 15 percent in 1989 (2,422 tons) as compared to 1987 (2,855). In general, total air emissions for 1989 reflected a 54 percent decrease from 1984 figures.

Another program, undertaken by General Dynamics in 1985, seeks to attain "zero discharge" by setting the goal of having no RCRA-manifested wastes leaving company facilities. This goal might be considered by some to be unrealistic and even unachievable. However, by 1988, the company had succeeded in eliminating almost 40 million pounds of waste discharge (a 72 percent reduction compared to 1984) while at the same time increasing sales by over 28 percent.

VOLUNTARY PARTICIPATION IN EPA PROGRAMS

In addition to what has been described above, many private-sector industrial activities have agreed to reduce chemical emissions voluntarily at the request of the EPA. The EPA and the participants believe that such a nonregulatory approach holds great promise for inspiring change and developing a willingness to do what is right.

One such voluntary program is the 33/50 Project; it is administered by the EPA's Office of Toxic Substances. The project has as its objective reducing the release and off-site transfer of 17 chemical and/or chemical compounds used in various manufacturing processes. These include high-priority chemicals such as cadmium, mercury, lead, and benzene.

The program established 1988 as its base year [when 1.4 billion pounds of these chemicals were reported on the Toxics Release Inventory (TRI)] and seeks to achieve a 50 percent reduction by 1995. An interim goal of 33 percent reduction by 1992 was also set (hence the name 33/50).

Approximately 6,000 companies have been asked to participate, and by early 1992 more than 700 of the largest had voluntarily instituted programs to achieve the desired reduction goals. While companies can use any methodology, the EPA believes that source reduction and product substitution will be the most likely approaches employed. Dow Chemical's WRAP program, discussed above, resulted directly from the company's commitment to support the EPA 33/50 initiative.

Another major program that has been largely successful in obtaining voluntary participation from the private sector and government is called Green Lights. It encourages the use of more energy-efficient lighting, which pays direct dividends by lowering annual electric bills. It also has the added benefit of reducing overall electrical demands and associated emissions from power plants.

The EPA reports that by early 1992, more than 400 corporations, states, governments, and other activities had committed over 2 billion square feet of office space to the Green Lights program.

Annual savings projected from reducing electricity consumption and air emissions amount to \$700 million. If all eligible facilities were to sign up, electricity use for lighting could be cut in half and the total national electricity demand could be cut as much as 10 percent.⁴

⁴*Securing Our Legacy: An EPA Progress Report 1989 - 1991*, 175 R-92-001, p. 21, April 1992.

Other voluntary initiatives that are gaining industry support include the following:

- ◆ A program in which nine companies will reduce air emissions of several toxic air pollutants by over 80 percent.
- ◆ A program through which the EPA is notifying companies of "environmental concerns" over their use of certain chemicals or chemical groups and passing on information to promote the safe handling of such chemicals from a risk management perspective.
- ◆ A program to compile information on activities for preventing accidental releases of toxic chemicals.
- ◆ A program that has asked registrants of mercury paint preservatives to eliminate their use in interior paints.

THE GLOBAL ENVIRONMENTAL MANAGEMENT INITIATIVE

One final undertaking worthy of note here is the Global Environmental Management Initiative (GEMI).⁵ Formed in April 1990, GEMI is a partnership of 22 Fortune 500 companies dedicated to preserving and protecting the environment while simultaneously stimulating economic development. It has adopted four key strategies, as follows:

- ◆ Promote and develop tools and partnerships to implement the International Chamber of Commerce's Business Charter for Sustainable Development, or equivalents, in all industry segments.
- ◆ Stimulate, assemble, and promote worldwide critical thinking on environmental management. This furthers the development of systemic approaches to continuous environmental improvement through the integration of TQM and environmental management, or Total Quality Environmental Management (TQEM).
- ◆ Improve the content and media of environmental communications with interested publics, targeting the institutional investor as well as "socially responsible" stakeholder groups.
- ◆ Build the credibility and influence of GEMI through visibility of results. Attaining this goal involves sharing results by distributing a newsletter and a TQEM primer designed to facilitate the implementation of TQEM throughout industry.

⁵Information furnished by GEMI, 2000 L Street, N.W., Suite 710, Washington, DC 20036.

Specific achievements since inception include the conduct of conferences focused on basic TQEM concepts, on total quality measurements, and on development and implementation of corporate environmental policy. Future activities will continue to address how companies can promote sustainable development and improve their environmental performance.

The GEMI's commitment to sustainable development, to the sharing of information and experience, and to improved public communication enhances its potential as a viable component of any corporate pollution prevention program. GEMI has succeeded in highlighting the importance of integrating environmental considerations into corporate planning and decision-making, thereby reducing the potential for negative impacts and fostering environmental excellence in industries around the world.

The next chapter will give an overview of pollution prevention initiatives by the Military Services and the Defense Logistics Agency (DLA). Subsequent chapters will outline generic pollution prevention areas of DoD concern.

CHAPTER 4

Pollution Prevention Initiatives by the Military Services and the Defense Logistics Agency

As mentioned earlier, pollution prevention is not a totally new concept within DoD. The inclusion of pollution prevention "pillars" within environmental strategies and of pollution prevention organizational elements at the OSD, Military Service staff, major command, and installation levels clearly emphasizes the importance of pollution prevention relative to other key elements of the DoD environmental security program.

It should be noted, however, that the need to dedicate significant amounts of environmental resources to meeting compliance and restoration requirements has left the pollution prevention program somewhat under-resourced. In spite of this situation, the DoD Components all have active pollution prevention programs under way, and indications are that continued emphasis and increased resources will be directed toward these activities.

Embedded within DoD's new strategy for environmental security is the preference for preventing pollution rather than controlling it and for targeting technology to meet DoD environmental needs. DoD pollution prevention areas of concern are highlighted in Figure 4-1 and are discussed below and in the following chapter.¹

The *acquisition* life cycle for weapon systems and materiel (Figure 4-2) must be modified to include environmental issues in the decision-making process by calling for the evaluation of hazardous and environmentally damaging materials, as well as energy and raw materials uses, at the concept development and design phases, so that decisions can be made at the best time to reduce or eliminate environmental problems at the source.

The DoD *industrial operations* and logistics support organizations are looking at more effective ways to manage *hazardous materials* and modify equipment, technologies, and processes — all with the goal of reducing adverse environmental impacts. Pollution prevention is an essential element of environmental compliance for DoD installations.

¹The overviews presented here draw heavily from testimony provided by the DoD Components to the Senate Armed Services Committee, Subcommittee on Military Readiness and Defense Infrastructure, 9 June 1993.

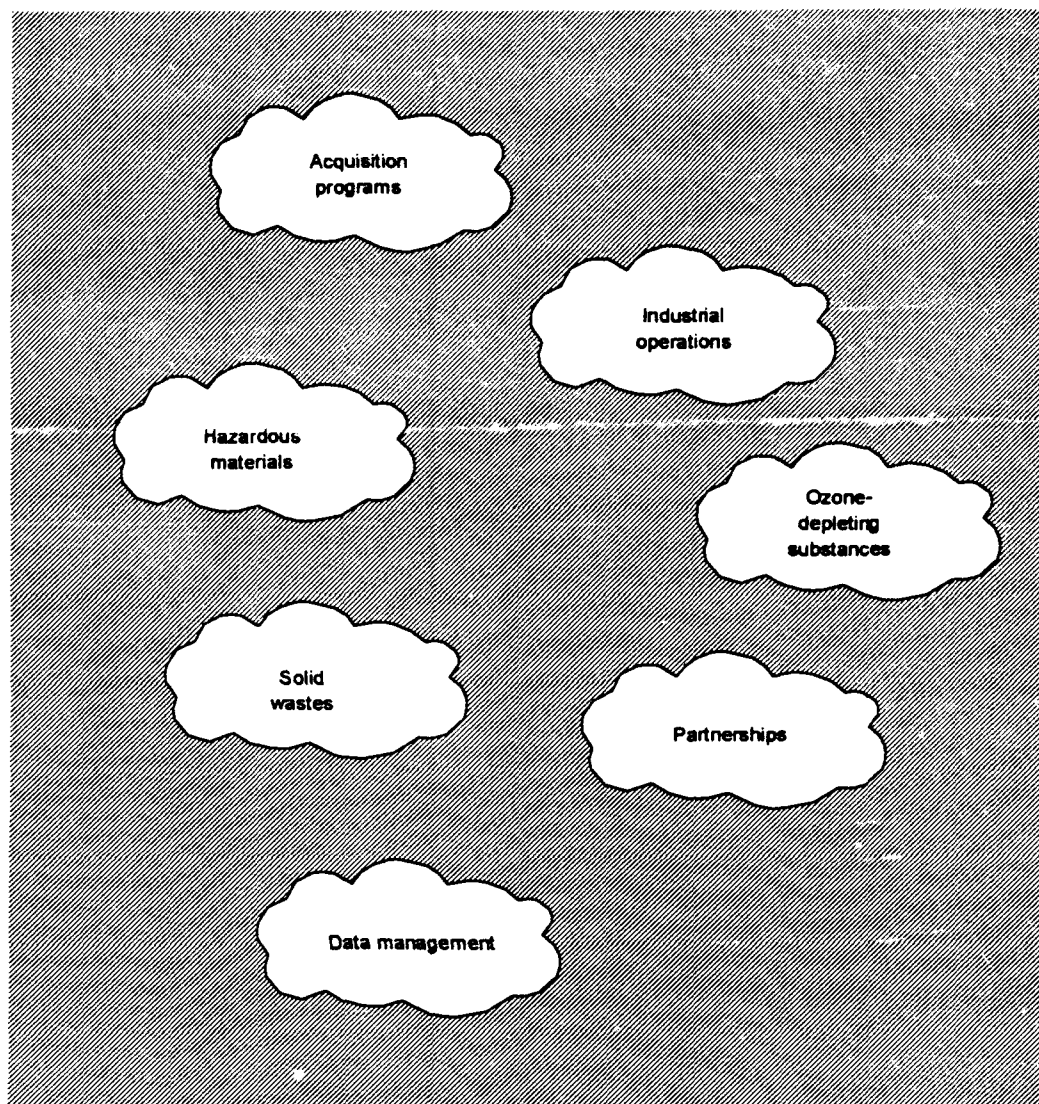
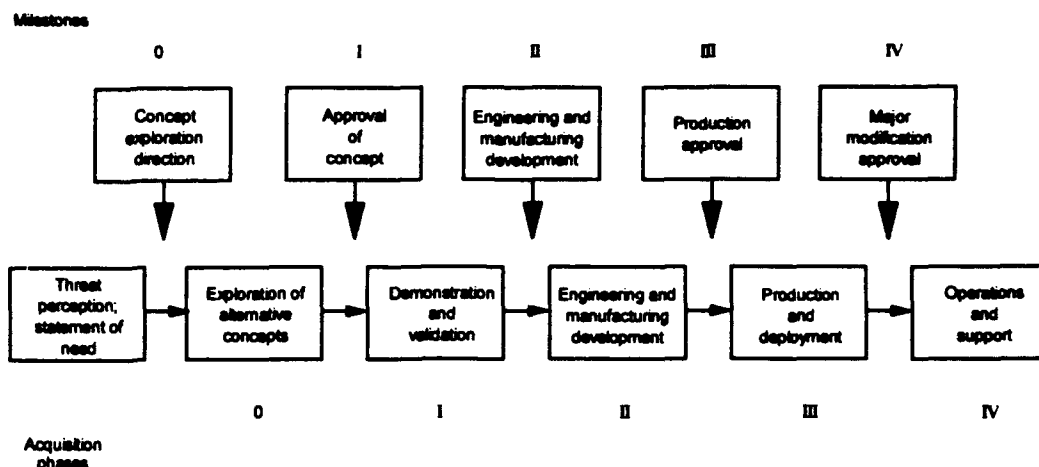


Figure 4-1.
DoD Pollution Prevention Areas of Concern

Ozone-depleting substances (ODSs) are of sufficient importance to be addressed separately. DoD has developed a strategy to comply with the accelerated Montreal Protocol's production phase-out schedules and is working actively and closely with private industry to find benign replacements or alternative technologies. DoD ODS strategy includes provisions for meeting military-mission-critical requirements by "banking" critical ODSs until suitable alternatives are developed.



Note: Based on U.S. Army Materiel Command, *Material Developer's Guide for Pollution Prevention*, 28 August 1992.

Figure 4-2.
DoD Acquisition Process Phases and Milestones

The DoD has recognized the need to pursue aggressive *solid waste* reduction programs to come to grips with the impending crisis in the national capacity to deal with the growing mountains of trash. Recycling programs and cooperative programs with state and local entities are beginning to pay dividends. DoD also has responsibilities under EO 12780's affirmative procurement provisions for recycled materials and has already taken positive steps for fly ash in concrete, recycled paper, and re-refined lube oils.

Although DoD has been remarkably successful in reducing *hazardous waste* disposal by over 55 percent over the past 5 years using various hazardous waste minimization (HAZMIN) initiatives, the accounting of the true environmental benefits accrued is frustrated by inconsistencies in metrics, *data*, and reporting. The TRI reporting requirement under EPCRA and the waste reduction reporting required by the PPA, both of which become effective for Federal facilities in 1994, will provide a much better picture of the real environmental impacts of DoD operations. The ongoing data collection efforts in support of the new CAA toxic emissions inventory requirements will also support the information needs for TRI reporting.

Lastly, forming *partnerships* with industry to cross-fertilize pollution prevention technologies and processes, and with other Federal and state agencies to share information, offers tremendous payback potential. DoD is actively pursuing changes to military standardization documents and specifications to minimize or eliminate the use of hazardous substances and is working with private-sector standard-setting organizations, such as the American Society for

Testing and Materials (ASTM), to replace military standards with private-sector standards wherever appropriate.

Significant progress has been made by the DoD Components. The rest of this chapter addresses the specifics of pollution prevention programs within the Army, Navy, Marine Corps, Air Force, and DLA.

ARMY

The Army's commitment to pollution prevention is embodied in *U.S. Army Environmental Strategy Into the 21st Century*,² which was approved and signed by the Secretary of the Army and the Chief of Staff of the Army on 19 November 1992. The pollution prevention "pillar" detailed therein includes source reduction efforts in weapon systems and industrial processes, resource recovery and recycling, energy efficiency, and other aspects of waste reduction associated with installations and logistics management/support. Emphasis will also be placed on environmental R&D programs and technology development for source reduction. The Army has a broad goal of adopting and implementing an integrated approach to minimize all environmental contamination and pollution. The focus is on multimedia concerns; elimination of hazardous material uses, operations, or processes; risk minimization; and instilling of the pollution prevention ethic throughout the Army.

Also in 1992, the Army Environmental Policy Institute hosted a workshop focusing on national trends in pollution prevention and issued a report — *Pollution Prevention: National Trends, Forecasts, and Options for the Army*, which formed much of the basis for Chapter 2. Suggestions included realigning the environmental commitment to focus on pollution prevention as the preferred alternative for sustained compliance, to promote the waste management hierarchy, to reduce energy consumption, and to encourage conservation.

Necessary updates to Army Regulations are under way by the HQDA Director of Environmental Programs, to shift the waste reduction programs away from the ongoing "HAZMIN" types of efforts and toward new thrusts associated with the PPA, EPCRA, and EO 12856. A pollution prevention guidance manual for use by Army installations has been drafted. Efforts are under way by the Army Environmental Center (AEC) to incorporate pollution prevention principles and technologies throughout the life cycle of weapon systems to improve material management practices to minimize the quantities and types of hazardous materials at Army installations and to favor the use of recycled products.

The Army Acquisition Pollution Prevention Support Office (AAPPSO), within the Army Materiel Command (AMC), is supporting the Army Acquisition Executive, procurement executive officers, and acquisition program managers to ensure that pollution prevention concerns are considered throughout the acquisition program life cycle. The AAPPSO also plays a big role in identifying

²U.S. Army, *U.S. Army Environmental Strategy Into the 21st Century*, 19 November 1992.

eliminating where possible the use of hazardous substances in Army standards and specifications and is working with the ASTM and other private-sector groups to develop and enhance the use of nongovernment specifications and standards. The AAPPISO has been instrumental in the development of a comprehensive program to replace ozone-depleting compounds in Army weapon systems.

The Army is also aggressively pursuing environmental training as a mechanism to ensure that all personnel — military and civilian — develop a strong environmental ethic. An environmental training master plan was developed in 1992 to help institutionalize environmental training within the formal Army school system. Pollution prevention training has already been integrated into the intern program training curricula for people in weapon systems program management, industrial design, engineering, and logistics.

The AMC HAZMIN Program progress report (draft) for calendar year 1992 reports a reduction of 70.1 percent in industrial hazardous waste (1985 baseline).³ This corresponds to a generation of 20.7 million kilograms, down from 70.5 million kilograms in 1985. This was accomplished by a number of source reduction, recycling, treatment, and disposal changes; some increment would meet the criteria for pollution prevention discussed above.

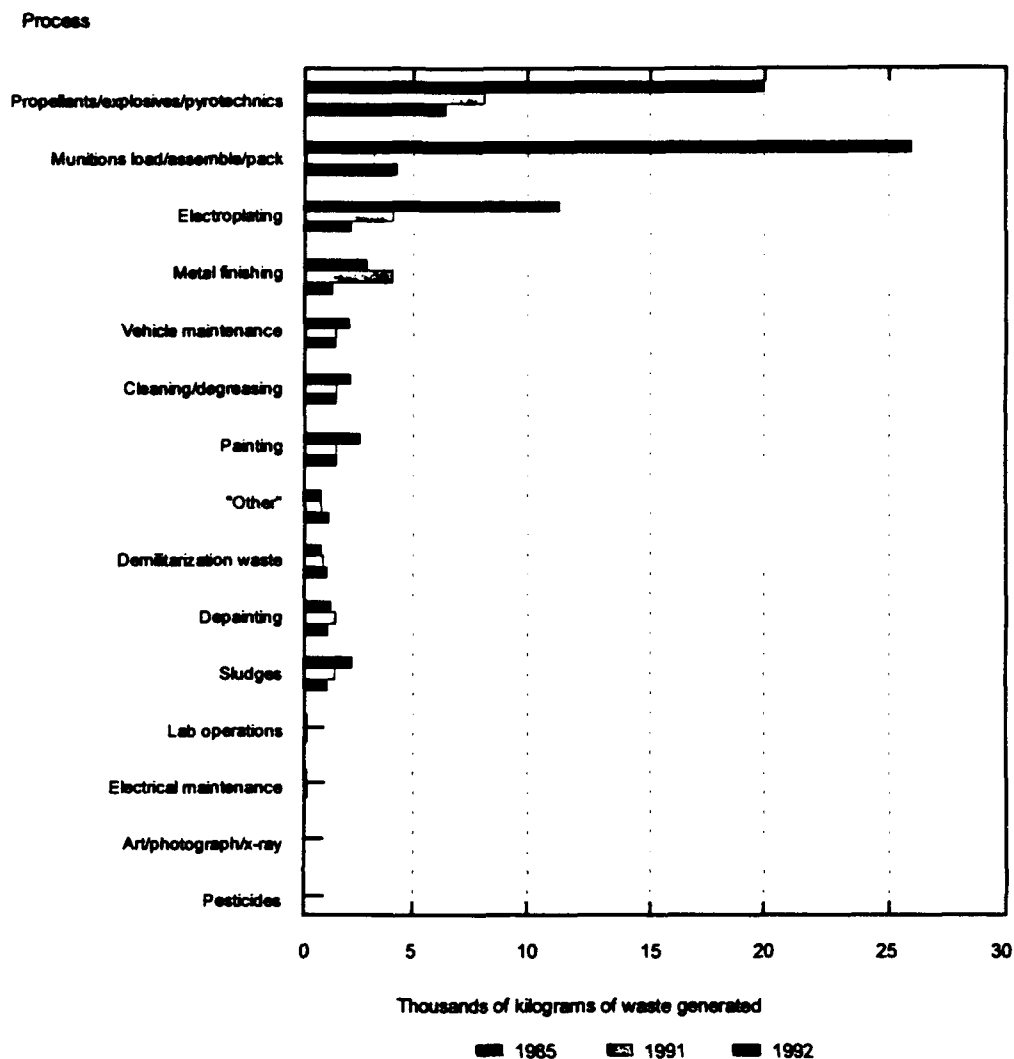
The majority of the impressive waste generation reductions have been achieved by evolutionary — rather than revolutionary — solutions, including “good housekeeping” and a great deal of applied common sense. Examples include such efforts as the addition of drip pans between electroplating tanks and greater emphasis on the segregation of nonhazardous components from hazardous waste streams. Increased R&D will be required for product substitution and fundamental industrial process changes in order to continue reduction of hazardous waste generation. Figure 4-3 shows process-specific hazardous waste reductions Army-wide for the past 3 years.

NAVY

The environmental policy and goals established by the Chief of Naval Operations include a commitment to reducing hazardous waste and a recognition of the need to establish a hazardous materials control program. Navy policy is being updated to reflect new pollution prevention initiatives. The focus of the ongoing hazardous materials pollution prevention program is on minimizing and controlling hazardous materials acquisition and use via substitution, process change, use of nonhazardous materials in new systems wherever possible, and the extension of shelf lives to reduce excess materials.⁴ The program applies to

³U.S. Army Materiel Command, *Hazardous Waste Minimization Program, Progress Report* — 1992, Draft, July 1993.

⁴U.S. Navy, OPNAVNOTE 5090 Ser 451/8U584639, *Subject: Navy Hazardous Waste Minimization Program*, 18 May 1988.



Note: Figure based on Army Materiel Command's draft HAZMIN program progress report; see footnote 3, this chapter.

Figure 4-3.
Army Materiel Command HAZMIN Industrial Waste Key Processes

both shore and shipboard systems — it is to be noted that hazardous waste from ships is reported by the supporting shore activity.

The Naval Energy and Environmental Support Activity reports that the Navy had successfully reduced the amounts of hazardous waste disposed of by 55 percent by the end of 1992, measured against a baseline of 1987.⁵ The Navy's logistics commands that operate depot-level repair activities (Naval Sea Systems Command and Naval Air Systems Command) both have active HAZMIN

⁵U.S. Navy, Naval Energy and Environmental Support Activity, *Draft Calendar Year 1992 Hazardous Waste Minimization Report*, NEESA 19-003.3, May 1993.

programs and were particularly successful in reducing overall hazardous waste disposal, from 33,000 tons in 1987, to 10,000 tons in 1992.

A significant element contributing to these reductions is improved hazardous materials management. For example, in 1990 the Naval Air Warfare Station, Point Mugu, opened a hazardous material reuse store and recycling center. Over \$400,000 in cost savings/cost avoidance/revenue were realized in FY92 from reductions in inventory, reductions in procurement of hazardous materials, and reduced waste disposal costs.

The Navy controls the use of hazardous materials afloat through an "authorized use list" that catalogs the proper use of some 5,800 items and specifies the organizational units allowed to use them. This list has provided a focus for product substitution studies. The successful use of such lists has been demonstrated at the Naval Aviation Depot, Alameda, and one is under development for Navywide shore facilities. Navy source reduction efforts have led to successful process changes such as replacing parts cleaning using halogenated solvents with cleaning using high-pressure water washers and eliminating halogenated solvent paint strippers, chromic acid strippers, carbon removers, aerosol-based oils, and corrosion inhibitors in industrial maintenance processes.

The Navy has also focused on "shelf life" management and reuse of hazardous materials internally before resale or disposal. For example, the Navy has recommended that the General Services Administration and DLA extend the shelf life of 50 products.

Under the Navy Supply System Plastics Reduction in the Marine Environment (PRIME) program, the Navy has reduced the amounts of plastics loaded onto ships by 14 percent (about 700,000 pounds) since 1989. Stringent rules to retain plastic waste aboard ships have reduced plastic waste discharges at sea by 70 percent.

Recognizing that providing environmental awareness training to all its personnel is an essential element of a sound pollution prevention program, the Navy recently (April 1992) published its training plan for environmental and natural resources. The plan, a broad-based document identifying manpower and training needed to support the environmental program, is used to bolster management, planning, programming, and budgeting for all aspects of the environmental training support system. It also identifies general environmental awareness training for the entire Navy, including military and civilian personnel at all levels of command.

MARINE CORPS

The Marine Corps commitment to pollution prevention is outlined in its 1993 *Environmental Campaign Plan*. The Marine Corps will "avert environmental contamination and degradation through the promotion of pollution prevention methods such as source reduction, resource recovery, and recycling."⁶

The Marine Corps is developing a new order on hazardous material pollution prevention, with anticipated publication by the end of FY93. The intent is to instill and institutionalize the pollution prevention ethic in all operations, including the application of total quality leadership (TQL) concepts.

Hazardous waste minimization studies at the Marine Corps' major logistics bases at Albany, Georgia, and Barstow, California, have identified opportunities for more efficient process technologies and equipment. The Marine Corps is actively entering pollution prevention case studies into the EPA's *Pollution Prevention Information Clearinghouse (PPIC) data base* — specifically into the Federal Agency Mini-Exchange (FAME) portion of the Pollution Prevention Information Exchange System (PIES).

AIR FORCE

Air Force pollution prevention policy was recently articulated in a January 1993 memorandum signed by the Chief of Staff and the Secretary of the Air Force, as follows: "Our goal is to prevent future pollution by reducing use of hazardous materials and releases of pollutants into the environment to as near zero as feasible. To achieve this, we must quickly move away from dependence on hazardous materials, actively reduce our waste streams, reuse the wastes we do generate, recycle what we cannot use, and expand purchasing programs for recycled products."⁷

To accomplish the above, the Air Force Pollution Program Action Plan is structured into six major objectives; these objectives are outlined below and illustrated in Table 4-1.

The first objective is to institutionalize pollution prevention concepts in the acquisition process by 1994 through the use of policies, procedures, training, and contractual provisions and by proposing any necessary changes to the Federal Acquisition Regulation.

The second objective is to reduce the use of hazardous materials in existing systems by product substitutions (especially for ODSs) and cleaner industrial technologies.

⁶U.S. Marine Corps, 1993 *Environmental Campaign Plan*.

⁷U.S. Air Force Memorandum, Subject: *Air Force Pollution Prevention Program – Action Memorandum*, 7 January 1993.

Table 4-1.
Summary of Air Force Pollution Prevention Activities

- | |
|---|
| <ul style="list-style-type: none">• New Weapon Systems
Institutionalize pollution prevention concepts in the acquisition process• Existing Weapon Systems
Institutionalize pollution prevention; review and change task orders, military specifications, and military standards• Installations and government-owned, contractor-operated (GOCO) facilities
Set more stringent goals for hazardous materials waste reductions• Technology Insertion
Acquire state-of-the-art technology• New Technology
Conduct RDT&E for pollution prevention• Investment Strategy
Ensure funding for pollution prevention |
|---|

The third objective includes specific numeric reduction goals for hazardous materials, hazardous waste, and solid waste disposal. For example, the Air Force has instituted a "hazardous material pharmacy" concept at nonindustrial installations to convey the idea that hazardous materials will be as carefully controlled as prescription drugs. Such industrial recycling centers deal with solvents, petroleum products, antifreeze, and other common hazardous substances and have demonstrated rapid return on investment, well above and beyond the environmental enhancement benefits due to pollution prevention.

The fourth and fifth objectives deal with assessing existing pollution prevention technologies and — when requirements cannot be met — initiating R&D efforts.

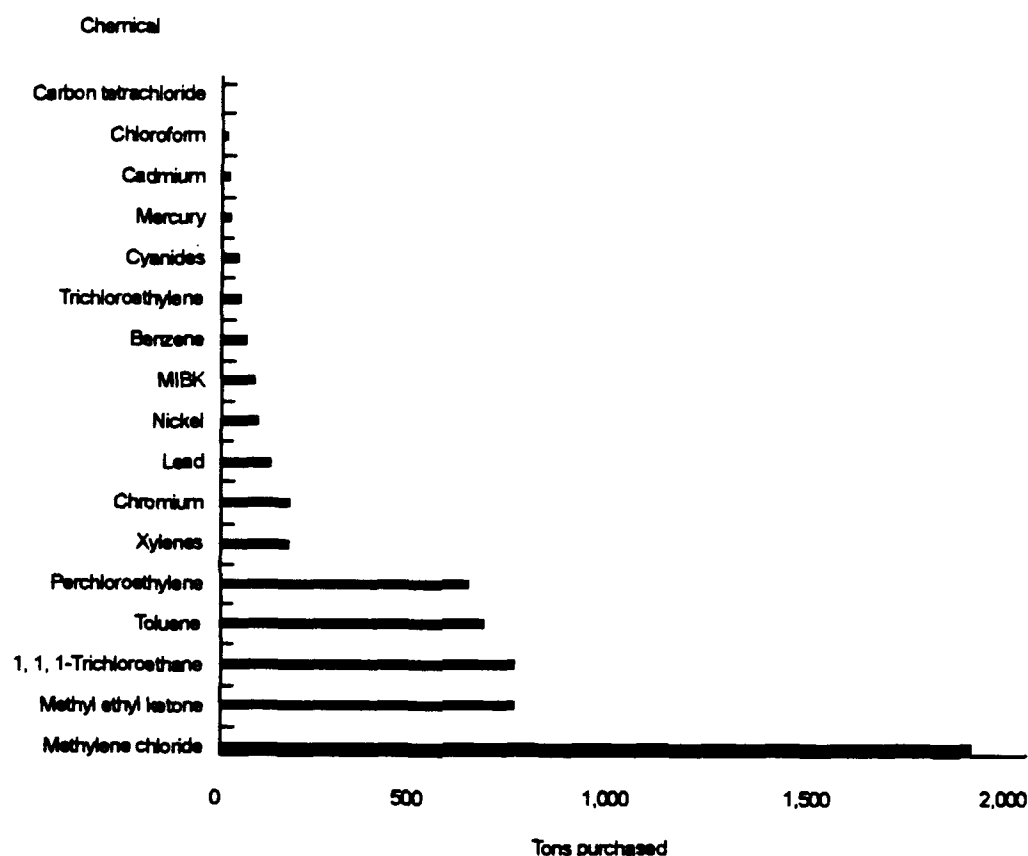
The final objective ties investments to specific reductions in material use, waste generation, and prioritized requirements based on return on investment. The Air Force's *Installation Pollution Prevention Program Manual*⁸ provides detailed guidance for actions to implement these objectives.

The Air Force has also issued a detailed policy statement on ozone-depleting chemicals (ODCs).⁹ A commitment was made (and has been met) to no longer purchase new ODSs as firefighting agents or refrigerants by June 1993, to manage current refrigerant inventory to operate chillers until the end of their economic life; to cease acquisition of commercial vehicles with ODC equipment by June 1993; and to cease purchase of new ODC solvents by April 1994.

⁸U.S. Air Force, *Installation Pollution Prevention Program Manual*, January 1992.

⁹U.S. Air Force Memorandum, *Subject: Air Force Ban on Purchase of Ozone Depleting Chemicals (ODCs) — ACTION MEMORANDUM*, 4 January 1993.

The Air Force Materiel Command has aggressively pursued reduction in the use of the 17 highly toxic/high-priority chemicals identified by the EPA for reductions in conjunction with the private-sector 33/50 Project related to the TRI. These chemicals originate in four major industrial processes: plating, cleaning, painting, and stripping. Through use of a fiscally responsible approach, remarkable savings in purchases of these chemicals and reductions in releases to the environment have been achieved. Figure 4-4 presents data on amounts purchased in 1992, to be reduced in future years.



Source: Based on U.S. Air Force Materiel Command briefing, HQAFMC/CEV, Subject: *AFMC Pollution Prevention Program*, 30 March 1993.

Note: 1992 EPA-17 chemicals baseline goal: by 31 December 1996, reduce by 50 percent.

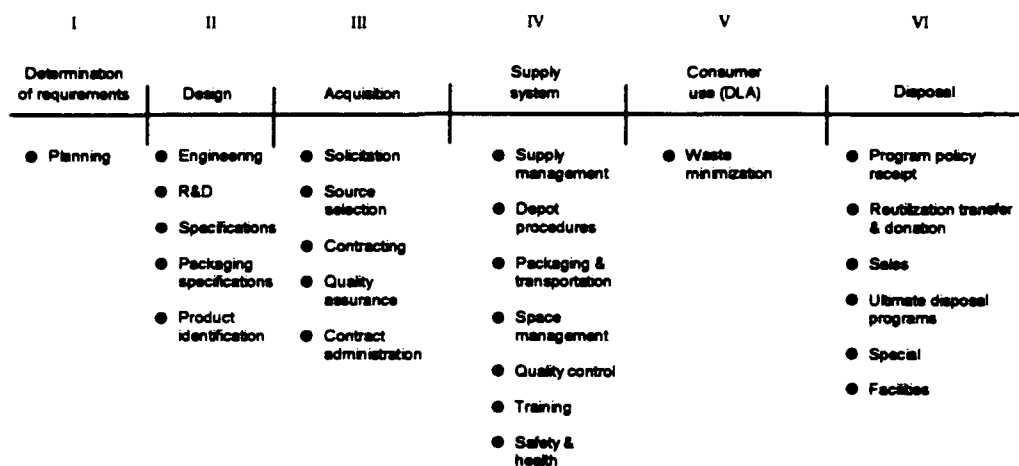
Figure 4-4.
AFMC 1992 "EPA-17" Chemicals Baseline

Environmental education and training, for military and civilian personnel, from general officers to enlisted ranks, is the cornerstone of increased environmental awareness and pollution prevention throughout the Air Force. This is accomplished through command awareness briefings and is institutionalized in the related Air Force schools.

DEFENSE LOGISTICS AGENCY

The *DLAs Environmental Protection Manual*¹⁰ provides policy on hazardous waste management, hazardous materials management, recycling, and other environmental programs. It is being updated to reflect the new requirements of the PPA and EPCRA.

The DLA's Comprehensive Hazardous Material Management Program provides cradle-to-grave management of DLA-controlled hazardous properties; it is organized into six life-cycle phases, shown in Figure 4-5.



Note: Based on DLA Information Paper, DLA-SEP, Subject: *Defense Logistics Agency Hazardous Material Minimization Program*, 2 March 1993.

Figure 4-5.
Life Cycle of DLA-Managed Hazardous Material

The DoD Components use some 5 million national-stock-numbered items. The inventory of commodities managed by DLA — spare parts, clothing, fuel, food, and medical and construction supplies — represents 70 percent of all items used by the armed forces. Only a small portion are considered hazardous materials, but these still require close and continued attention to ensure safety and prevention of environmental degradation.

The DLA acquisition centers that manage commodities have hazardous materials management teams that seek out nonhazardous or less hazardous substitutes for hazardous commodities. In many cases military specifications and standards are de facto world standards for industry; hence, changes can have a major effect on civilian as well as DoD uses of hazardous materials. DLA

¹⁰Defense Logistics Agency, *DLA Environmental Protection Manual*, DLAM 6050.1, 16 July 1991.

acquisition teams have made significant progress toward reducing the use of chlorofluorocarbons (CFCs), asbestos, and plastic packaging in particular.

For example, at the Defense Electronics Supply Center, an acquisition hazardous materials team has removed the CFC use requirement from three electronics parts test methods. Over 650 standardization documents were reviewed to isolate CFC requirements. Five standards that had called exclusively for a CFC (specifically, methyl chloroform) as an agent in the test method were disclosed. Three have already been revised to permit non-CFC agents while maintaining standard integrity; one has been revised to no longer require carbon tetrachloride (also CFCs) and methyl chloroform; and the fifth is currently under review. These changes have affected over 3,900 detailed military specifications and over 800 manufacturing facilities. Anecdotally, one manufacturer has reported that these changes have eliminated the need to purchase over 1,600 pounds of CFCs annually, with a projected cost savings of \$6,500.

The DLA is also supporting the DoD affirmative procurement program for recycled products. With regard to lubricating oils, for example, DLA, as the DoD-wide item manager, has worked with the military specifications "owner" — the Army's Belvoir R&D Center — to change the solicitation for future lube oil purchases to include a requirement for 25 percent (minimum) re-refined lube oil in the base stock. Since DLA procured over \$12 million in lube oils in FY92, it is anticipated this will provide a significant impetus to the national (re)use of re-refined oil and conservation of virgin oil.

SUMMARY AND FUTURE DIRECTION

As illustrated by the foregoing discussion, DoD and its Components have made much progress toward establishing sound pollution prevention programs. However, given the opportunities available for expanded partnerships with industry and for modifications to in-house industrial activities, policies, and procedures, there is much more that needs to be done.

The next chapter identifies specific pollution prevention activities that DoD must continue to focus on if the long-term goals and objectives of the environmental program are to be fully realized.

CHAPTER 5

Pollution Prevention Opportunities for DoD

At this point we focus the foregoing discussion on the areas that we believe present the greatest opportunity for strengthening the DoD pollution prevention program. Placing emphasis on these areas will affirm DoD's commitment to sound environmental management and reduce the overall burden resulting from past and present, less proactive practices.

ACQUISITION

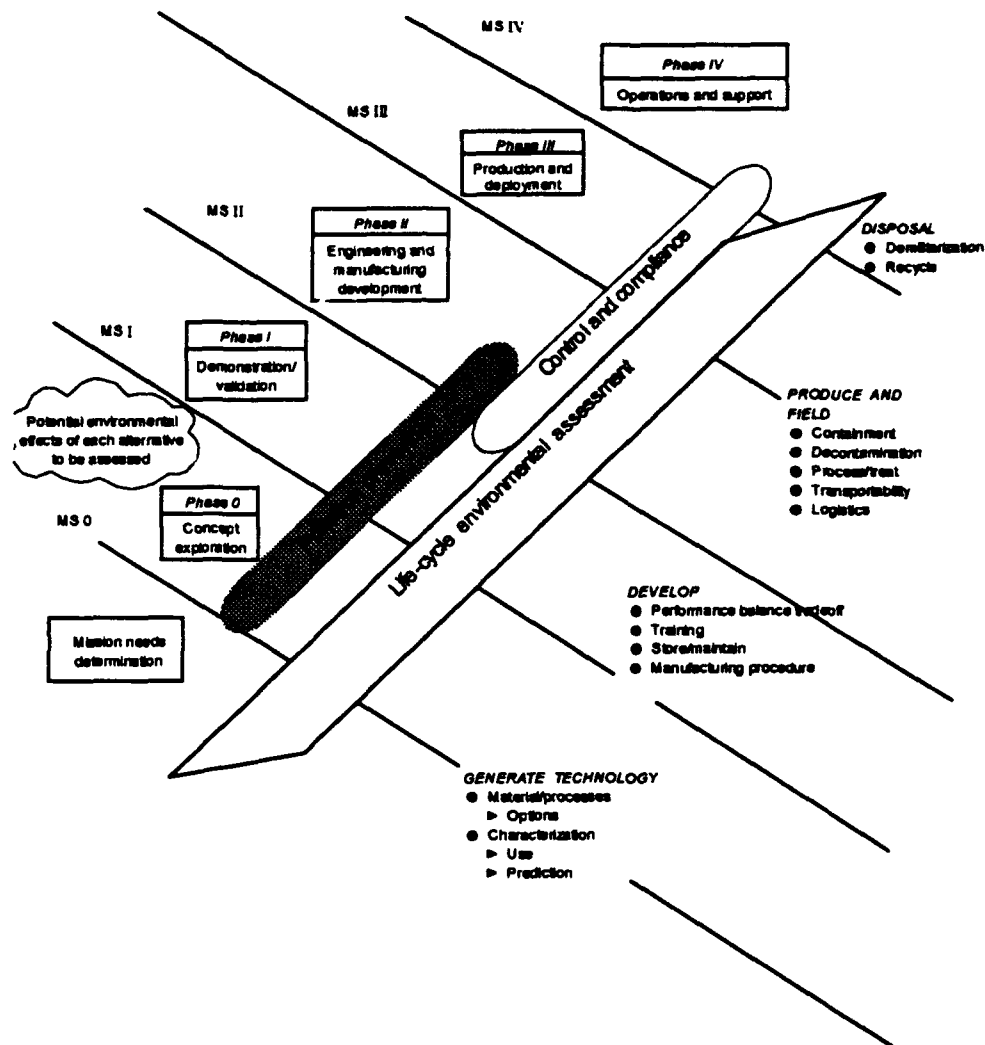
Weapon Systems Life-Cycle Environmental Concerns

The recognized interrelationship between environmental concerns and DoD acquisition programs leads to a need for actions to incorporate and coordinate life-cycle analyses, efficient energy management, efficient use of raw materials, and other strategies into every phase of the acquisition process; see Figures 5-1 and 5-2.

Pollution prevention, risk reduction, and more efficient use of energy and raw materials need to become integral, visible requirements during all phases of the acquisition life cycle for major weapon systems and materiel. Environmental reviews must become a significant factor in the DoD milestone approval processes at all echelons within the Military Services and OSD.

Existing DoD directives and instructions for acquisition programs do not adequately address these requirements, and oversight lacks any apparent teeth. Pollution prevention concerns have to be infused into every aspect of the acquisition program, not stand separately. DoD system procurement requirements and specifications must be amended to cause prime contractors to embed pollution prevention practices in their own operations and to flow down the requirements for them to their subcontractors.

The acquisition corps requires education regarding environmental concerns, particularly those pertaining to pollution prevention. This type of training must be prominently included in the curricula of mandatory training of the corps. The Defense Systems Management College has taken steps to integrate pollution prevention into its courses, as have the Army Logistics Management College and the Air Force Institute of Technology.



Notes: MS = milestone. Based on U.S. Army Materiel Command, Production Base Modernization Activity, *Life-Cycle Environmental Guide for Weapons Systems Project Managers*, October 1992.

Figure 5-1.
Acquisition Life-Cycle Environmental Concerns

Life-Cycle Cost Analysis

Life-cycle costing techniques can often reveal hidden long-term environmental and liability costs. Present techniques for pollution prevention costing are usually limited to the manufacturing components of the life cycle, and accounting systems usually do not adequately track environmental costs.

The magnitude of these nontraditional costs can be expected to overwhelm the "usual" manufacturing related-costs and may become significant factors in acquisition decision-making. Conventional techniques do not account for the full

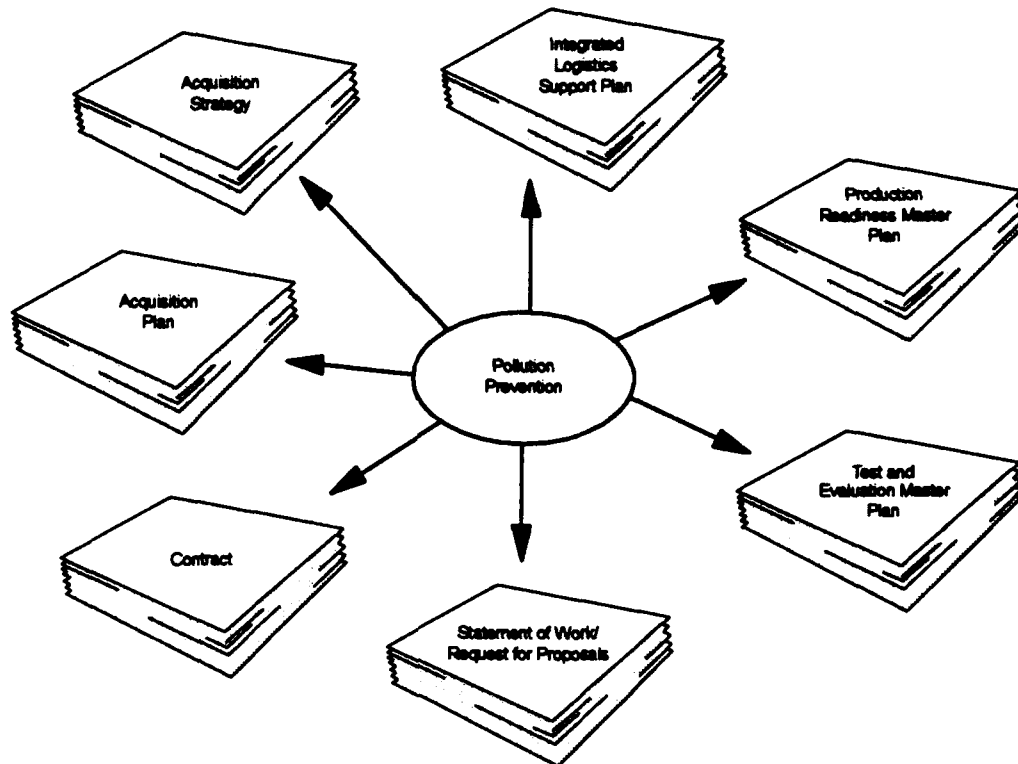
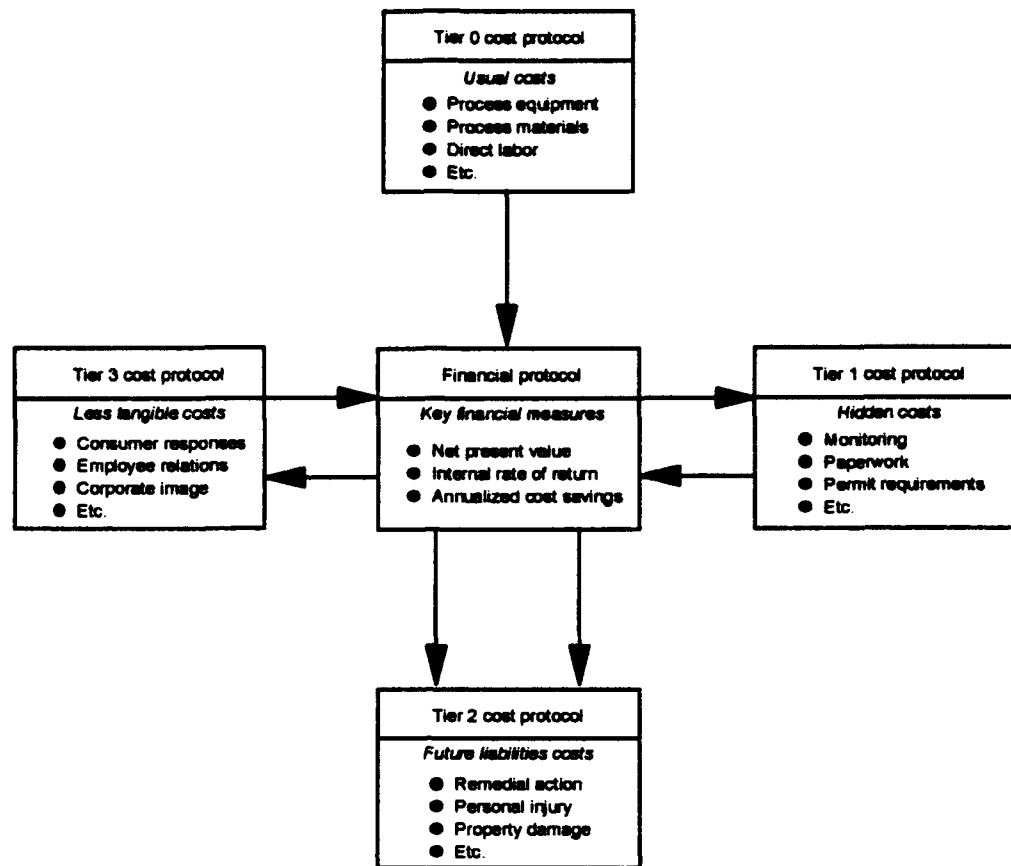


Figure 5-2.
Integrating Pollution Prevention into Acquisition Program Elements

range of environmental expenses that an industrial operation may incur. They do not typically use a sufficiently long time period to fully capture the benefits of many pollution prevention projects, nor do they adequately deal with the probabilistic nature of pollution prevention benefits, which are often difficult to estimate.

The EPA has developed a total cost assessment guide embodying a heretofore comprehensive financial protocol and providing procedures for hidden costs (see Figure 5-3). A comparable system for DoD acquisition programs' cost estimating procedures has not yet been established.

Expanding the inventory of cost items beyond the confining boundaries of *direct costs* may tip the balance in favor of a pollution prevention project. *Indirect costs* (including regulatory compliance costs, training, insurance, etc.) often are hidden sources of savings that could be allocated to the pollution prevention project. Reduced *potential liabilities* are subject to a great deal of uncertainty because their timing and magnitude are unpredictable, but they may be significant and should not be ignored. Finally, *less tangible costs* may also deliver substantial benefits from improved image or employee health and safety.



Source: U.S. EPA, *Total Cost Assessment: Accelerating Industrial Pollution Prevention Through Innovative Project Financial Analysis*, EPA/741/R-92/002.

Note: Based on EPA Guide.

Figure 5-3.
EPA Method for Estimating Pollution Prevention Life-Cycle Costs

Design for the Environment

The DoD Components have already adapted many DfE concepts, as noted in Chapter 3. In order to fully implement DfE, the systems engineering approaches presently applied for DoD acquisition programs (e.g., value engineering protocols) will need revision. However, the cost benefits of attacking these problems early on are intuitively obvious and can be affirmed via life-cycle cost analyses.

INDUSTRIAL OPERATIONS

Process Changes

Industrial operations at DoD industrial manufacturing, rework, and maintenance facilities have been studied in considerable detail by military technical experts and private-sector contractors for opportunities to modify procedures, for recycling opportunities, or for possible adjustments, all with the intent of reducing waste generation. For example, the joint EPA/DoD Waste Reduction Evaluations at Federal Sites program and the military commands' HAZMIN audit programs have recently documented opportunities and provided generic and site-specific recommendations for reductions in the generation of hazardous wastes.

Lessons learned have been shared among the affected communities and private-sector industries, and considerable progress has been made, as attested to by the reductions in DoD-wide hazardous waste generation in recent years. There are innumerable DoD examples of using high-pressure water/steam/detergent washers, ultrasonic parts washers, fluidized bed parts cleaners, etc. to replace degreasers that use chlorinated solvents. Similarly, there are many electroplating process modifications, principally in the form of in-process recycling, to regenerate plating baths or to recover the plating metals and eliminate or reduce wastewaters. These form the basis for much of the HAZMIN success thus far achieved by the Military Services and DoD agencies. Although these initiatives have made considerable progress, there remain both generic and process-specific technical and institutional impediments to implementing change.

Military Standardization Documents

Military standardization documents impose detailed technical requirements for commodities and procedures to be employed in procurement specifications and industrial operations.¹ They can extend considerably beyond the DoD's own facilities and operations — to the broader universe of private-sector manufacturing and service industries that either support DoD or simply accept military standards as universally applicable for certain items and methods.

In its simplest form, a military standard (or military specification, or technical guide, or depot maintenance work requirement, etc.) originates during the design and development of a weapon system or materiel. The acquisition program executive officer or program manager is the "requirements generating activity." The standard is codified and comes under the control of a standardization executive and a standards-preparing activity in a Military Service (or other DoD Component). When a need for change is identified, such as the need to substitute a benign or less deleterious substance for a hazardous substance,

¹ LMI Report PL107R1, *DoD's War on Hazardous Waste, Vol. 3: Identifying Specifications That Require the Use of Hazardous Substances*, Douglas M. Brown and Robert J. Baxter, July 1991.

then appropriate studies and analyses must be done to ensure that there is no loss of intended function or purpose of an item or process.

A recommendation to the "owner" of the standard causes further technical evaluations, including those by the requirements-generating activity, to ensure that there are no negative impacts on the item or process. If approved, an interim change may be authorized and/or the standardization document itself may be changed and guidance issued to the affected community regarding the changes. But this oversimplification masks the technical complexities and regulatory procedural details necessary to effect changes. Existing regulatory procedures tend to sustain the status quo and are conservative regarding change. The acquisition program manager's and/or the item manager's mindset must become receptive to pollution prevention changes.

The DoD has also been working with private-sector standard-setting organizations, such as the American Society for Testing and Materials (ASTM), to substitute nonmilitary standards for commodities and procedures shared with private industry. For example, the Military Services are working actively with ASTM Committee D-26 (Halogenated Solvents) to develop material specifications for recycled halons and with ASTM Committee E-50 (Environmental Assessments) to develop pollution prevention guidance protocols for implementation at industrial facilities.

The Military Services have also teamed up with the Aerospace Industries Association to produce an industry standard for management requirements for hazardous and other environmentally unacceptable materials. It will be available for DoD use to ensure effective pollution prevention programs in acquisition contracts.

Substitute Chemicals

Substituting benign or less hazardous substances for toxic or hazardous ones is a key means of pollution prevention through source reduction. The relationship to military standards is discussed above. The situation is most acute with regard to ODSs, discussed below.

The availability of "drop-in" substitutes for hazardous or toxic chemicals is generally poor unless process changes are also effected. For example, the use of aqueous citric acid solutions for metal parts cleaning to replace organic solvents has been extensively tested but found to work in only a limited number of specific applications.

Technology

Environmental assessment, pollution prevention, source reduction, and more efficient use of energy and raw materials must be embedded in the basic DoD acquisition processes. Until considerable progress is made in this direction, a significant DoD research, development, test, and evaluation (RDT&E) program is necessary to undertake basic RDT&E, demonstration, technology transfer, and implementation in support of DoD-unique requirements.

Areas of particular concern are DoD industrial rework, maintenance, and rehabilitation operations; pyrotechnic, explosives, and propellant manufacturing operations; material substitutions, with a special effort on ODSs in military applications; weapon systems and military materiel life-cycle designs, including the final stage of demilitarization; and technologies to support recovery, reuse, and recycling, in regard to both hazardous substances and ordinary solid wastes.

The need for pollution prevention RDT&E arises early in the acquisition process for weapon systems and materiel — often during the concept development or exploratory phase of a program. But there are also needs during the later phases of a program, such as design or operations, where generic or cross-cutting problems may arise that affect a number of systems or requirements. Priorities for pollution prevention RDT&E are generally based on reduction of emissions to the environment, efficiencies in energy and raw materials use, reduced operation and maintenance costs and capital costs; and (predicted) reductions of risks and liabilities.

The DoD management framework to coordinate pollution prevention RDT&E must be responsive to users' needs. The users, in this case, are not found in the environmental community, per se, but are the "requirements generators" in the acquisition programs and the "owners and operators" of the industrial processes.

HAZARDOUS MATERIALS

Supply Management

Purchasing and procurement agents have primarily been concerned with inbound movements of materials into facilities. Consideration is now being given also to how the materials will eventually leave. The Council of Logistics Management has coined the term "reverse logistics" to broadly refer to the logistics management skills involved in reducing, managing, and disposing of hazardous or nonhazardous wastes.

For example, warehouse facilities will have to be reevaluated (redesigned, reconfigured) to handle new materials management needs such as recycling and waste management in traditional materials receiving areas. DoD supply systems

need pollution prevention "discipline" to improve the procurement, issue, and use of hazardous materials to minimize excesses. Personnel involved in these operations need training that emphasizes personal safety and environmental awareness and is focused on proper handling and disposal practices and on minimizing waste generation.

The Navy's Authorized Use List procedures for hazardous materials afloat and the Air Force hazardous materials pharmacy approach are excellent examples of centralized management of hazardous materials at the installation level that brings the necessary attention and "command and control" to this logistics function.

Packaging

Environmentally aware packaging – "green" packaging – in DoD operations is related to the condition of the packaged items as well as to the packaging materials themselves. Military specifications for packaging are undergoing review to revise preservation, packing, and marking requirements to ensure adequate protection of the items during transportation and storage. For example, the DLA initiative to change from plastic "bubble-wrap" to biodegradable cellulosic materials for packaging a wide variety of specific items has already resulted in significant cost savings and environmental benefits to Defense agencies.

The Navy's initiatives to evaluate shelf-life codes for specific hazardous materials, mentioned above, have identified the opportunity to extend the shelf-life requirements for about 50 products that were unnecessarily contributing to hazardous waste generations.

DATA

Tracking Systems and Reporting Requirements

The availability and accuracy of data concerning hazardous materials use and hazardous waste generation are limited, and the data themselves are inconsistent across DoD organizations.

The once-per-year DoD-wide reporting requirement imposed under the Defense Environmental Management Information System has collected data on hazardous wastes disposed of off-site via the Defense Reutilization and Marketing Offices (DRMOs) and has little to do with total quantities of hazardous waste (or other solid wastes) generated, treated, or disposed of by the installations themselves.

Installations must also meet data collection and reporting demands imposed by lower echelon commands. The installations' submissions provide greater detail regarding waste generation, treatment, and disposal practices for specific waste types from industrial operations. However, these data are site- and process-unique, with characteristics not amenable to DoD-wide consolidation in their current formats. Further, EPA and various states have imposed their own regulatory hazardous and solid waste reporting requirements.

Since installations are typically overburdened by reporting requirements, the data and reports suffer from lack of quality assurance/quality control. Numerous local computer-based data bases and information management systems are in use to support the need. The necessity of integrating hazardous materials tracking into environmental areas of concern, or vice-versa, has only recently been realized: several systems based on existing logistics data bases and commercially available systems have been developed, but their linkage to hazardous waste and other environmental systems is only now coming forth.

The OSD acted on this problem in 1991 with a decision to bring DoD-wide environmental information management requirements under the control of a Defense Environmental Corporate Information Management (DECIM) system. Interim systems, taking advantage of the best of the many systems currently deployed across DoD commands and installations, will be mandated pending full analysis of the business process of environmental programs within DoD, to be followed by permanent systems for the long term.

Productivity Indices

The DoD commitment to reduce hazardous waste generation by 50 percent by 1992 has generally been met — OSD reports a reduction of 55 percent in hazardous waste disposal in 5 years (1987 - 1992). However, this statement requires some analysis. First, the computation is based on data for off-site disposal of hazardous wastes via the DRMO system — it generally does not include the amounts generated by installations, nor the amounts treated or disposed of directly by the installations themselves.

More importantly, the values are not related to any measure of production or activity — it is likely that some fraction of the reduction is attributable to simply shutting down or reducing certain activities and is not a real decrease resulting from improvements to processes or recycling. One could argue, on the other hand, that it does not matter, that the overall amount of hazardous waste introduced into the environment has been reduced, and that is what really counts, no matter how the reduction is achieved.

The conceptual and practical elements of "normalizing" waste measurements to account for changing operational activity levels — a "productivity index" system — have been studied for DoD and the Military Services by the Logistics Management Institute. The study concluded that DoD already collects enough data to support computation of a hazardous waste (by weight)/

workload (direct labor hours) index. The report cautions that data definitions and collection periods need to be consistent, that data for a single installation can fluctuate widely from year to year, and that short-term results may be misleading.²

Toxics Release Inventory

The DoD and the Military Services, which were previously exempt from compliance with the provisions of EPCRA (except for operating contractors at DoD GOCOs), are now planning to fully comply with EPCRA TRI requirements in 1994. The installations' CAA toxic emissions inventories should also serve as a source of data for TRI reporting.

The EPA's national reporting requirements, although complex, detailed, and evolutionary, have been well established for private industry.³ The necessary computer programs, electronic reporting methods, and analytical tools exist in the public domain, under EPA auspices. Although the TRI is not a pollution prevention program per se, it is an essential data collection effort for toxic and hazardous chemicals and has to be the focus for the pollution prevention program at an industrial installation.

The TRI program components may be summarized as follows: determine *applicable regulations* (Federal requirements imposed under EPCRA and Federal regulations are not necessarily the same as state requirements); use a *baseline study* to identify what chemicals come into the installation (including review of Material Safety Data Sheets, component by component) and determine which chemicals to track; identify reportable chemicals and threshold chemicals by comparison to the facility's TRI list of chemicals (40 C.F.R. 355); prepare a list of chemical hazard characteristics and a list of quantities of hazardous chemicals (TRI Tier I and II Reports); analyze processes and calculate/estimate emissions and disposal quantities (i.e., *mass balance*); and determine threshold chemicals, complete TRI forms, and submit *reports*. The major steps in the TRI process are shown in Figure 5-4.

PARTNERSHIPS

National Defense Center for Environmental Excellence

The NDCEE was established in 1989 by congressional direction to facilitate the transfer of environmentally acceptable technology, materials, and processes from DoD industrial activities to private industry, to provide training, and to undertake appropriate RDT&E applied to specifically identified areas of concern.

²LMI Report PL907R3, DoD's War on Hazardous Waste, Vol. 2: *An Indexing System for Measuring Hazardous Waste Reduction*, Douglas M. Brown, February 1991.

³U.S. EPA, *Toxic Chemical Release Inventory Reporting Form R and Instructions*, EPA 745-K-93-001, January 1993.

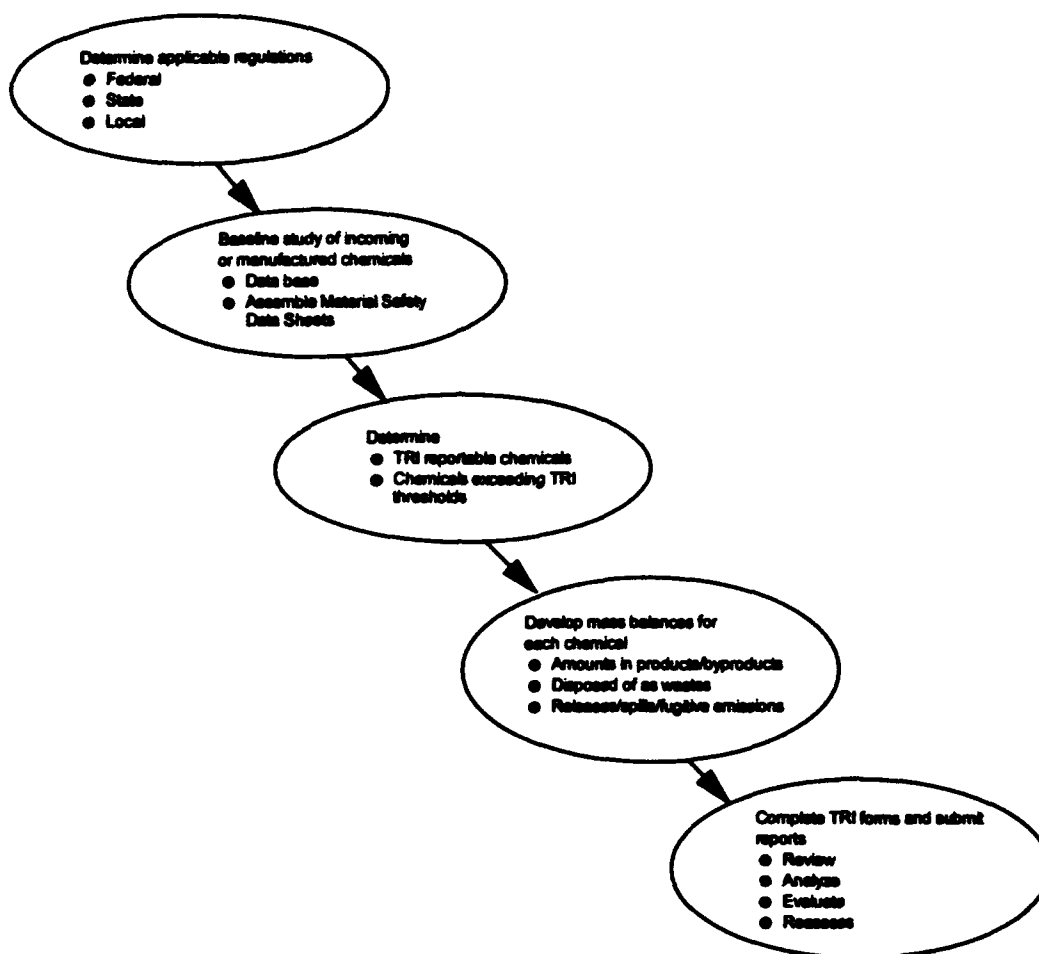
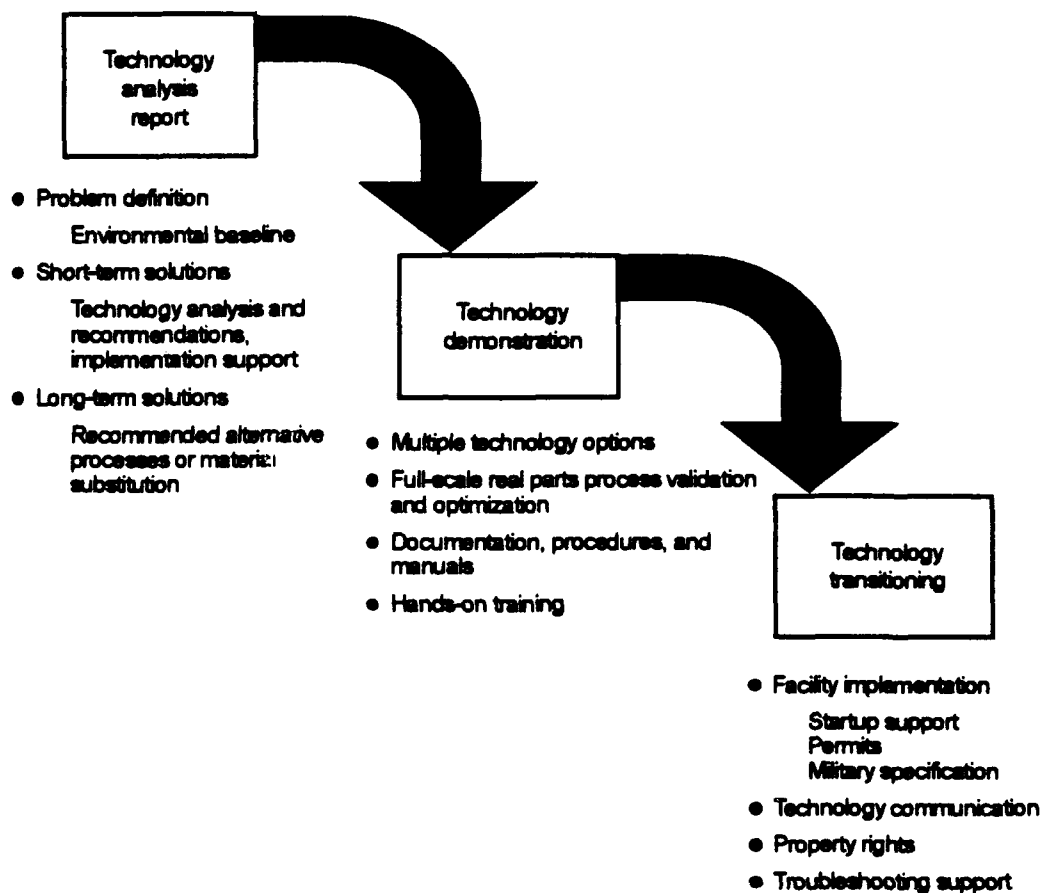


Figure 5-4.
TRI Process

The AMC serves as DoD's executive agent for the NDCEE (the AMC's NDCEE project management and contracting officer's technical representative functions are assigned to the AMC's Production Base Modernization Activity).

A number of boards and councils operating at appropriate organizational levels provide strategic policy/oversight, review, and identification of requirements and participate in technology identification, development, evaluation, and transfer to the user community. Active participation of private-industry trade groups and industrial manufacturing companies on the senior advisory council, and in technology development and testing programs, has fostered enhanced communication and information transfer among DoD Components and private industry. NDCEE pollution prevention functions are depicted in Figure 5-5.

A demonstration "mini" factory is being established at the NDCEE to illustrate and/or validate a number of pollution prevention technologies with applicability to DoD industrial operations. Areas of particular interest include waste



Note: Based on NDCEE program briefing, July 1993.

Figure 5-5.
NDCEE Pollution Prevention Functions

generating operations associated with industrial surface preparation (e.g., cleaning or stripping of parts or components) and surface finishing (e.g., organic coatings such as painting and inorganic coatings such as metal plating). Transfer of successfully tested new source reduction technologies includes a significant opportunity for hands-on training.

Private Industry

Opportunities for DoD partnerships with private industry typically involve information exchange or program management initiatives with trade associations. These organizations have developed pollution prevention programs, guidance, information exchanges, and centers of assistance. Several have already been discussed. Also, regional Manufacturing Technology Centers, established under the National Institute of Standards and Technology, provide a wide range of services to their constituencies, including individual project engineering,

training, demonstrations, and assistance in establishing pollution prevention programs and implementing specific pollution prevention projects.

The open scientific and technical literature includes several periodical technical journals dedicated to pollution prevention, and there is an abundance of professional organization conferences, symposia, information clearinghouses, and centers of assistance. The joint participation of DoD and private industry in these forums provides an ad hoc type of information exchange. An annual American Defense Preparedness Association conference, for example, is devoted to Defense/industry-related environmental topics, including pollution prevention. The NDCEE, described above, and GEMI (see Chapter 3) provide more specific partnerships.

The EPA and the States

A model for DoD/EPA/state partnerships was started in 1991 when the Army, Navy, and Air Force entered into an agreement with the EPA and with state and local governments to establish the TIPPP in the Norfolk, Virginia, area. The TIPPP has already developed a number of innovative joint pollution prevention management programs and technologies that have been transferred to the Military Services and the other participating agencies.

The EPA and nearly all the states have established centers of expertise for promotion of pollution prevention through efficient information transfer. A lexicon of sources of technical and programmatic assistance has recently been published by the EPA.⁴

The EPA's Pollution Prevention Information *Clearinghouse* (PPIC) is a multimedia clearinghouse of technical, policy, program, legislative, and financial information available in hard copy and electronically via the Pollution Prevention Information Exchange System (PIES). PIES is an EPA interactive PC-based system accessible through a modem to access technical and programmatic information, locate expert assistance, and solve problems.

A Federal Agency Mini-Exchange (FAME) has been established in PIES to assist in the transfer of information on pollution prevention programs and projects, including case studies, at Federal facilities. Pollution prevention programs in the various states and university-affiliated pollution prevention research and training assistance centers have been recently identified and summarized in the EPA's latest reference guide to pollution prevention resources.⁵

⁴U.S. EPA, 1993 *Reference Guide to Pollution Prevention Resources*, EPA/742/B-93-001, February 1993.

⁵*Ibid.*

OZONE-DEPLETING SUBSTANCES (ODSs)

Production Phaseout

Concern for the depletion of the stratospheric ozone layer has drawn worldwide attention to — and placed increasingly stringent controls on — the production of CFCs, halons, and certain other compounds collectively known as ODSs. The 1990 Clean Air Act Amendments adopted the 1989 Montreal Protocol scheduled phaseout of production of CFCs and halons by the year 2000.

In February 1992, the President advanced the date for the phaseout of production of Class I ODSs (defined as substances with high ozone-depleting potentials) to December 1995. Then, in November 1992, the parties to the Montreal Protocol further accelerated the phaseout of production of halons to January 1994 and lowered the production quotas for CFCs in 1994 and 1995 to 25 percent of 1986 levels.

Partnerships

Since the Military Services have a number of mission-critical uses for ODS compounds, they have begun extensive R&D programs and are working closely with the EPA and private industry to find suitable replacements or alternative technologies. But the task is not easy, and it has been made more challenging by the acceleration of the production phaseout dates. The Navy has established a CFC/Halon Information Clearinghouse (CHIC) for information exchange between the Military Services and private industry.

Critical Needs

The Military Services are working with DLA to establish a Defense reserve of ODSs to support military-mission-critical requirements, and are collaborating with the EPA to identify potential sources, both domestic and international, for recycled halons that would eliminate, or minimize, the need for continued production.

SOLID WASTE

Recycling

Data on nonhazardous-solid-waste generation and recycling by the Military Services and Defense agencies are collected on an annual basis via the Defense Environmental Management Information System. Data quality is generally poor, for the reasons given in the section on data earlier in this chapter. For most nonindustrial DoD installations, nonhazardous-solid-waste reduction and

recycling activities have significant environmental and economic paybacks and are the core of installation pollution prevention activities.

For example, in FY91, Navy installations recycled an average of 25 percent of the solid waste generated (approximately 400,000 tons recycled), primarily in the form of metals, and generated revenues of over \$18 million. Army and Air Force installations have achieved similar results.

Affirmative Procurement

The RCRA and EO 12780⁶ require Federal agencies to establish preference programs (i.e., affirmative procurement programs) favoring the purchase of products made with recycled materials. The EPA has developed affirmative procurement guidelines for fly ash in cement and concrete, retread tires, lubricating oils, building insulation, and paper.

In deference to this, DoD has made significant progress toward the substitution of fly ash in cement and concrete. Military specifications for these items have been amended to make the necessary changes where appropriate. Also, as noted above, DLA has amended procurement specifications for lubricating oil purchases to require 25 percent of re-refined oil in the feedstock. Similarly, OSD has issued policy guidance establishing a preference for recycled paper.⁷

INTEGRATED POLLUTION PREVENTION STRATEGY

Cleanup, Compliance, Conservation, and Pollution Prevention (C-cubed, P-squared)

Within the construct of the DoD C-cubed, P-squared environmental security program, it is noteworthy that pollution prevention not only stands as a major program area (pillar), it transcends the other major program areas. Pollution prevention is the method of choice for achieving and sustaining long-term compliance; it is the preferred process for preventing the necessity for future cleanups; and it is the essence of conservation of natural resources and energy. It is appropriate, therefore, that a DoD strategic plan integrate both the direct source-reduction elements of pollution prevention and indirect, holistic pollution prevention. Such a comprehensive strategy should strive both to meet the specific needs identified by EO 12856 and to address the over-arching national environmental ethic.

The new EO 12856 specifically mandates that each Federal agency develop a written pollution prevention strategy (within 1 year) including a policy

⁶ *Federal Agency Recycling and the Council on Federal Recycling and Procurement Policy*, 31 October 1991.

⁷ Office of the Secretary of Defense, Assistant Secretary of Defense (Production and Logistics), Memorandum, 3 February 1993, Subject: *Preference for Recycled Paper*.

statement that applies to both facility management and acquisition and a commitment to utilize pollution prevention as the primary means of achieving and maintaining compliance. The Military Services and subordinate echelons could "tier" from such a document to develop strategic and tactical plans to fit their own needs.

There are a number of models and schools of thought on strategic planning. The recent experiences of the Army in developing its environmental strategy for the 21st century have been discussed in an Army publication that may be used to facilitate DoD's pollution prevention strategic plan development process.⁸

Investment Strategy

A framework and method for identifying requirements and prioritizing funding for pollution prevention initiatives must be developed and integrated into the overall DoD planning, programming, budgeting, and execution system.

DoD installations seldom have the luxury of funding beyond the minimum level necessary to overcome the overwhelming financial needs of day-to-day compliance with environmental laws and regulations. Most compliance is funded from installation operation and maintenance accounts, where pollution prevention must compete for dollars. The need to adopt preventive measures that will result in long-term savings is recognized but is overcome by daily urgencies of "survival." A decade ago, when faced with a similar problem for cleanup of contamination from past activities, DoD and Congress worked together to establish the centrally managed and centrally funded Defense Environmental Restoration Account (DERA). The HAZMIN portion of DERA funding was remarkably successful and highly cost-effective in providing "seed" money for worthwhile studies and demonstration projects. A similar effort to institutionalize pollution prevention programs and fund "core" activities, such as basic research, training, identification of crosscutting issues, etc., may have merit and bears consideration.

⁸ Army Environmental Policy Institute, *A Strategic Planning Primer: Models, Methods, and Misunderstanding*, AEPI-PS-392, June 1992.

CHAPTER 6

Recommendations

We recommend that the Office of the Secretary of Defense quickly endorse the new Executive order on Federal Compliance With Right-to-Know Laws and Pollution Prevention Requirements (EO 12856) and call on the Military Services and Defense agencies to act on it.

The new Executive order mandates that Federal facilities fully comply with EPCRA and the PPA beginning in 1994, including the TRI reporting provisions. Federal facilities must review and revise their standardization documents, beginning in 1994. Federal facilities must develop pollution prevention strategies, programs, and plans at all echelons. Also, they must develop baselines of uses of toxic chemicals and reduce all forms of releases by 50 percent between 1994 and 1999.

These requirements present substantial challenges (and costs) to a DoD already faced with significant reductions, realignments, and restructuring. However, the potential environmental and economic benefits are significant. Proactive implementing plans have been developed by the Military Services and other DoD Components, and their affected communities have been alerted. A strong endorsement of the new Executive order by OSD will ensure timely action and a good probability for success in meeting the goals.

We recommend that OSD move to articulate a broadly defined pollution prevention strategy and direct the Military Services and Defense agencies to develop aligned strategies, plans, goals, and assessments. We also recommend that the OSD and DoD Components' strategies embrace partnerships with the EPA, the states, and the private sector (especially via such initiatives as the NDCEE and GEMI).

Any DoD pollution prevention strategy should typically include terms such as "comprehensive"; "integrated"; "holistic"; "cost-effective"; "risk-reducing"; "liability-reducing"; "conserving of natural resources (raw materials)"; and "conserving of energy." These attributes, in their widest environmental context, indicate the need for a broadly defined, over-arching DoD pollution prevention strategy, in the form of a strategic plan with a commonality of purpose with national environmental principles and appropriately tiered supplements for implementing organizations within the Defense Components.

The initial successes of the TIPPP and the positive initiatives evolving at the EPA's PPIC and the NDCEE are consistent with Presidential and congressional intent and merit affirmative action by Defense agencies and the Services.

We recommend that DoD's leadership affirm its support for pollution prevention by appropriate remarks in various public forums and by endorsing model installations and model acquisition programs concepts for pollution prevention.

The DoD has the opportunity to exercise national leadership by moving quickly to fully integrate pollution prevention concepts into environmental security and other acquisition and technology programs.

The top leadership of the DoD organizations should unequivocally and visibly support the concepts and programs with appropriate statements of affirmation, support of resource requirements, awards and rewards, etc. Environmental awareness training, focusing on the pollution prevention ethic, is an essential element to foster the necessary "corporate culture" change that needs to be effected. The model installations concepts developed by DoD to foster excellence in installation management are readily transferable to pollution prevention programs at industrial facilities. These concepts are also readily transferable to model acquisition programs.

We recommend that the Defense Acquisition Board and its counterparts in the Defense Components establish specific requirements for environmental documentation, including pollution prevention requirements, at each milestone review. We also recommend that DoD acquisition directives be amended to incorporate Design for the Environment and total life-cycle environmental cost estimating procedures.

Pollution prevention concepts need to become more visible and meaningful requirements during all phases of the acquisition life-cycle process. Existing requirements in DoD acquisition regulations need to be refined and enforced via the acquisition milestone approval process. Design for the Environment concepts, already in use in private industry, need to be embedded in the design phases of weapon systems and materiel acquisition programs. DoD life-cycle cost estimating procedures need to be amended to properly account not only for the overt environmental costs associated with manufacturing operation but also for hidden environmental costs such as remedial actions required for items or materiel not properly demilitarized or disposed of.

We recommend that DoD supply system item managers undertake commodity-specific pollution prevention opportunity assessments for those items containing hazardous materials. We also recommend that procedures for revising DoD standardization documents be streamlined for those involving hazardous materials. This effort should emphasize the development and use of private-sector standardization documents to support pollution prevention initiatives.

The traditional wholesale and retail supply systems of the Military Services and Defense agencies do not support timely, effective management of environmentally significant commodities such as hazardous or toxic materials or hazardous wastes. Numerous examples of site-specific initiatives, apart from traditional supply system frameworks, have demonstrated substantial opportunities for cost savings through greater efficiencies in material supply procedures

and waste reduction. The current systemic inefficiencies offer considerable opportunities for improvement.

Certain DoD commodities with toxic or hazardous constituents are of sufficient quantity or frequency of use that they might benefit from a commodity-specific pollution prevention opportunity assessment.

The systematic review and revision of all DoD standardization documents involving hazardous or toxic materials is an overwhelming task in terms of sheer numbers. Computer-based digitizing and review is the only logical approach for a systemic solution. However, for those standardization documents now heavily used at the industrial facilities and operations of the Military Services and Defense agencies, there is already considerable knowledge of the problematic requirements that need to be addressed in a timely manner. Facilitating these kinds of changes has considerable potential for rapid technical and cost efficiencies. The effort to make greater use of private-sector standardization requirements has demonstrated considerable paybacks and merits further pursuit, particularly of those problematic requirements already identified by the DoD industrial operations.

We recommend that OSD and the DoD Components continue to aggressively pursue existing programs, including RDT&E programs to reduce future dependence on ozone depleting substances.

The mandate to phase out production of ODSs has a direct impact on critical DoD military mission needs for these substances. Because no acceptable substitutes are currently available, an aggressive RDT&E program is necessary to develop alternatives for existing and new systems that employ such substances. The acquisition program managers must work to reduce future dependency on ODSs, and the Military Services and DoD components need to work to identify and — wherever possible — limit the need for ODSs in mission-critical applications.

We recommend that OSD and the DoD Components continue to work closely with the EPA to effect affirmative procurement of recycled commodities, including DoD commodity-specific pollution prevention opportunity assessments and revisions to standardization documents.

The OSD policy for implementing EO 12780, *Federal Agency Recycling and the Council on Federal Recycling and Procurement Policy*, affirms the Department's implementation of the mandate to ensure that specifications and statements of work clearly include the use of recycled materials where economically feasible for direct acquisition of the five categories of commodities for which guidelines have been established by the EPA (i.e., fly ash in cement and concrete, retread tires, lubricating oils, building insulation, and paper). Recycling coordinators for the Military Services and the other DoD Components are working to execute the policy. Systematic identification of standardization documents affecting specific commodities, and effective information exchange of changes and proposed changes, could facilitate this process. Development and application of related

private-sector standardization documents to DoD acquisition programs would also support DoD affirmative procurement in a manner consistent with Presidential direction and congressional intent.

We recommend that nonhazardous-solid-waste source reduction and recycling be integrated into pollution prevention requirements established for acquisition programs and DoD installations. We also recommend that nonhazardous-solid-waste pollution prevention be considered in efforts related to military standardization documents (e.g., for packaging requirements) and affirmative procurement programs.

The national problems in solid waste management are also prevalent in DoD, resulting in the conclusion that more emphasis needs to be placed on source reduction and recycling of solid wastes. There are many examples of cooperative efforts with state and local entities that have achieved considerable success, particularly with recycling initiatives. The benefits to those DoD installations that reach out to their local communities for cooperative solid waste programs have been well documented. The solid waste crisis gives additional impetus for review of DoD standardization documents to ensure the most efficient packaging, for example, and to give preference to recycled materials. DoD acquisition program managers should apply similar considerations to new weapon systems and materiel.

We recommend that OSD and the DoD Components continue to work aggressively within the DECIM and DoD Corporate Information Management framework to develop standard pollution prevention information systems for DoD-wide use. We also recommend that DoD work with other Federal agencies and the EPA to ensure the broadest and most effective use of the PPIC, the TRI, and other nationwide public systems for data collection, analysis, and information exchange.

Data reporting requirements are generated by regulation-driven programs and by information needs for command and control within the various bureaucracies. The former includes the EPA's TRI system and other RCRA, CERCLA, etc. mandated reports to EPA and to state or local regulatory agencies. The development of nationwide data elements/definitions and reporting systems would be most helpful for DoD-wide use but may be impracticable. The prevailing need for DoD installations to meet a large number of differing data reporting requirements for a variety of data "sinks" will most likely persist.

Pollution prevention data systems must deal with an information explosion. Yet the challenge remains to get the right information to the right user at the right time. The systematic sharing of information on new programs, processes, technologies, etc. has to be able to deal with a wide range of user interests within DoD (e.g., acquisition program managers, industrial operations technical staff, installation environmental coordinators, etc.) and among counterparts in private industry.

We recommend that OSD undertake a study of the pros and cons of an environmental investment strategy that includes a centrally managed and centrally funded transfer account for pollution prevention initiatives.

The definition uncertainties and the TQM-ish nature of pollution prevention, combined with an austere climate leading to concentration on "survival"-only types of requirements, have left the preventive types of initiatives generally under-resourced.

The centrally managed and funded Defense Environmental Restoration Account for cleanup of contamination from past activities has been remarkably successful and highly cost-effective in providing seed money for worthwhile studies and demonstration projects. This same approach may be effective to promote leadership in pollution prevention core activities such as basic research, training, identifying crosscutting issues, etc., that may otherwise not compete successfully for funding in other appropriations.

APPENDIX A

EPA Memorandum Defining Pollution Prevention



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D C 20460

MAY 28 1992

OFFICE OF
THE ADMINISTRATOR

MEMORANDUM

SUBJECT: EPA Definition of "Pollution Prevention"

FROM: P. Henry Habicht II
Deputy Administrator

TO: All EPA Personnel

EPA is seeking to integrate pollution prevention as an ethic throughout its activities, in accordance with the national policy expressed in the Pollution Prevention Act of 1990. Your individual efforts to push development of new opportunities, approaches, and processes to prevent pollution are impressive and exciting.

While the concept of pollution prevention is broadly applicable--a tool to accomplish many environmental tasks--this memo attempts to guide more consistent use of the term in our activities and written materials. Pollution prevention requires a cultural change--one which encourages more anticipation and internalizing of real environmental costs by those who may generate pollution, and which requires EPA to build a new relationship with all of our constituents to find the most cost-effective means to achieve those goals.

The following EPA "Statement of Definition" is a formal embodiment of what has been the Agency's working definition of pollution prevention, and is consistent with the Pollution Prevention Act of 1990 and the Agency's 1991 Pollution Prevention Strategy. It makes clear that prevention is our first priority within an environmental management hierarchy that includes: 1) prevention, 2) recycling, 3) treatment, and 4) disposal or release.

While it is subject to further refinement, this definition should provide a common reference point for all of us. As you review and apply the definition in your work, please keep the following points in mind:

- As always, whether the pollution prevention option is selected in any given situation will depend on the

requirements of applicable law, the level of risk reduction that can be achieved, and the cost-effectiveness of that option.

- Accordingly, the hierarchy should be viewed as establishing a set of preferences, rather than an absolute judgement that prevention is always the most desirable option. The hierarchy is applied to many different kinds of circumstances that will require judgement calls.

- Drawing an absolute line between prevention and recycling can be difficult. "Prevention" includes what is commonly called "in-process recycling," but not "out-of-process recycling." Recycling conducted in an environmentally sound manner shares many of the advantages of prevention, e.g. energy and resource conservation, and reducing the need for end-of-pipe treatment or waste containment.

As EPA looks at the "big picture" in setting strategic directions for the decade ahead, it is clear that prevention is key to solving the problems that all our media programs face, including the increasing cost of treatment and cleanup. In the common-sense words of Benjamin Franklin, "an ounce of prevention is worth a pound of cure."

Please use the Statement of Definition of Pollution Prevention in all of your EPA activities.

POLLUTION PREVENTION: EPA STATEMENT OF DEFINITION
(pursuant to the Pollution Prevention Act of 1990
and the Pollution Prevention Strategy)

Under Section 6602(b) of the Pollution Prevention Act of 1990, Congress established a national policy that:

- pollution should be prevented or reduced at the source whenever feasible;
- pollution that cannot be prevented should be recycled in an environmentally safe manner whenever feasible;
- pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible; and
- disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner.

Pollution prevention means "source reduction," as defined under the Pollution Prevention Act, and other practices that reduce or eliminate the creation of pollutants through:

- increased efficiency in the use of raw materials, energy, water, or other resources, or
- protection of natural resources by conservation.

The Pollution Prevention Act defines "source reduction" to mean any practice which:

- reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and
- reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants.

The term includes: equipment or technology modifications, process or procedure modifications, reformulation or redesign of products, substitution of raw materials, and improvements in housekeeping, maintenance, training, or inventory control.

Under the Pollution Prevention Act, recycling, energy recovery, treatment, and disposal are not included within the definition of pollution prevention. Some practices commonly described as "in-process recycling" may qualify as pollution prevention. Recycling that is conducted in an environmentally sound manner shares many of the advantages of prevention--it can reduce the need for treatment or disposal, and conserve energy and resources.

Pollution prevention approaches can be applied to all pollution-generating activity, including those found in the energy, agriculture, Federal, consumer, as well as industrial sectors. The impairment of wetlands, ground water sources, and other critical resources constitutes pollution, and prevention practices may be essential for preserving these resources. These practices may include conservation techniques and changes in management practices to prevent harm to sensitive ecosystems. Pollution prevention does not include practices that create new risks of concern.

In the agricultural sector, pollution prevention approaches include:

- reducing the use of water and chemical inputs;
- adoption of less environmentally harmful pesticides or cultivation of crop strains with natural resistance to pests; and
- protection of sensitive areas.

In the energy sector, pollution prevention can reduce environmental damages from extraction, processing, transport, and

combustion of fuels. Pollution prevention approaches include:

- increasing efficiency in energy use;
- substituting environmentally benign fuel sources; and
- design changes that reduce the demand for energy.

For more information contact:

- the Pollution Prevention Policy Staff (260-8631), or
- the Pollution Prevention Division, Office of Pollution Prevention and Toxics (260-3357)

APPENDIX B

Executive Order 12856, Federal Compliance With Right-to-Know Laws and Pollution Prevention Requirements

Presidential Documents

Title 3—**Executive Order 12856 of August 3, 1993****The President****Federal Compliance With Right-to-Know Laws and Pollution Prevention Requirements**

WHEREAS, the Emergency Planning and Community Right-to-Know Act of 1986 (42 U.S.C. 11001–11050) (EPCRA) established programs to provide the public with important information on the hazardous and toxic chemicals in their communities, and established emergency planning and notification requirements to protect the public in the event of a release of extremely hazardous substances;

WHEREAS, the Federal Government should be a good neighbor to local communities by becoming a leader in providing information to the public concerning toxic and hazardous chemicals and extremely hazardous substances at Federal facilities, and in planning for and preventing harm to the public through the planned or unplanned releases of chemicals;

WHEREAS, the Pollution Prevention Act of 1990 (42 U.S.C. 13101–13109) (PPA) established that it is the national policy of the United States that, whenever feasible, pollution should be prevented or reduced at the source; that pollution that cannot be prevented should be recycled in an environmentally safe manner; that pollution that cannot be prevented or recycled should be treated in an environmentally safe manner; and that disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner;

WHEREAS, the PPA required the Administrator of the Environmental Protection Agency (EPA) to promote source reduction practices in other agencies;

WHEREAS, the Federal Government should become a leader in the field of pollution prevention through the management of its facilities, its acquisition practices, and in supporting the development of innovative pollution prevention programs and technologies;

WHEREAS, the environmental, energy, and economic benefits of energy and water use reductions are very significant; the scope of innovative pollution prevention programs must be broad to adequately address the highest-risk environmental problems and to take full advantage of technological opportunities in sectors other than industrial manufacturing; the Energy Policy Act of 1992 (Public Law 102–486 of October 24, 1992) requires the Secretary of Energy to work with other Federal agencies to significantly reduce the use of energy and reduce the related environmental impacts by promoting use of energy efficiency and renewable energy technologies; and

WHEREAS, as the largest single consumer in the Nation, the Federal Government has the opportunity to realize significant economic as well as environmental benefits of pollution prevention;

AND IN ORDER TO:

Ensure that all Federal agencies conduct their facility management and acquisition activities so that, to the maximum extent practicable, the quantity of toxic chemicals entering any wastestream, including any releases to the environment, is reduced as expeditiously as possible through source reduction; that waste that is generated is recycled to the maximum extent practicable; and that any wastes remaining are stored, treated or disposed of in a manner protective of public health and the environment;

Require Federal agencies to report in a public manner toxic chemicals entering any wastestream from their facilities, including any releases to the environment, and to improve local emergency planning, response, and accident notification; and

Help encourage markets for clean technologies and safe alternatives to extremely hazardous substances or toxic chemicals through revisions to specifications and standards, the acquisition and procurement process, and the testing of innovative pollution prevention technologies at Federal facilities or in acquisitions;

NOW THEREFORE, by the authority vested in me as President by the Constitution and the laws of the United States of America, including the EPCRA, the PPA, and section 301 of title 5, United States Code, it is hereby ordered as follows:

Section 1. Applicability.

1-101. As delineated below, the head of each Federal agency is responsible for ensuring that all necessary actions are taken for the prevention of pollution with respect to that agency's activities and facilities, and for ensuring that agency's compliance with pollution prevention and emergency planning and community right-to-know provisions established pursuant to all implementing regulations issued pursuant to EPCRA and PPA.

1-102. Except as otherwise noted, this order is applicable to all Federal agencies that either own or operate a "facility" as that term is defined in section 329(4) of EPCRA, if such facility meets the threshold requirements set forth in EPCRA for compliance as modified by section 3-304(b) of this order ("covered facilities"). Except as provided in section 1-103 and section 1-104 below, each Federal agency must apply all of the provisions of this order to each of its covered facilities, including those facilities which are subject, independent of this order, to the provisions of EPCRA and PPA (e.g., certain Government-owned/contractor-operated facilities (GOCO's), for chemicals meeting EPCRA thresholds). This order does not apply to Federal agency facilities outside the customs territory of the United States, such as United States diplomatic and consular missions abroad.

1-103. Nothing in this order alters the obligations which GOCO's and Government corporation facilities have under EPCRA and PPA independent of this order or subjects such facilities to EPCRA or PPA if they are otherwise excluded. However, consistent with section 1-104 below, each Federal agency shall include the releases and transfers from all such facilities when meeting all of the Federal agency's responsibilities under this order.

1-104. To facilitate compliance with this order, each Federal agency shall provide, in all future contracts between the agency and its relevant contractors, for the contractor to supply to the Federal agency all information the Federal agency deems necessary for it to comply with this order. In addition, to the extent that compliance with this order is made more difficult due to lack of information from existing contractors, Federal agencies shall take practical steps to obtain the information needed to comply with this order from such contractors.

Sec. 2-2. Definitions.

2-201. All definitions found in EPCRA and PPA and implementing regulations are incorporated in this order by reference, with the following exception: for the purposes of this order, the term "person", as defined in section 329(7) of EPCRA, also includes Federal agencies.

2-202. *Federal agency* means an Executive agency, as defined in 5 U.S.C. 105. For the purpose of this order, military departments, as defined in 5 U.S.C. 102, are covered under the auspices of the Department of Defense.

2-203. *Pollution Prevention* means "source reduction," as defined in the PPA, and other practices that reduce or eliminate the creation of pollutants through: (a) increased efficiency in the use of raw materials, energy, water, or other resources; or (b) protection of natural resources by conservation.

2-204. *GOCO* means a Government-owned/contractor-operated facility which is owned by the Federal Government but all or portions of which are operated by private contractors.

2-205. *Administrator* means the Administrator of the EPA.

2-206. *Toxic Chemical* means a substance on the list described in section 313(c) of EPCRA.

2-207. *Toxic Pollutants*. For the purposes of section 3-302(a) of this order, the term "toxic pollutants" shall include, but is not necessarily limited to, those chemicals at a Federal facility subject to the provisions of section 313 of EPCRA as of December 1, 1993. Federal agencies also may choose to include releases and transfers of other chemicals, such as "extremely hazardous chemicals" as defined in section 329(3) of EPCRA, hazardous wastes as defined under the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901-6986) (RCRA), or hazardous air pollutants under the Clean Air Act Amendments (42 U.S.C. 7403-7626); however, for the purposes of establishing the agency's baseline under 3-302(c), such "other chemicals" are in addition to (not instead of) the section 313 chemicals. The term "toxic pollutants" does not include hazardous waste subject to remedial action generated prior to the date of this order.

Sec. 3-3. Implementation.

3-301. *Federal Agency Strategy*. Within 12 months of the date of this order, the head of each Federal agency must develop a written pollution prevention strategy to achieve the requirements specified in sections 3-302 through 3-305 of this order for that agency. A copy thereof shall be provided to the Administrator. Federal agencies are encouraged to involve the public in developing the required strategies under this order and in monitoring their subsequent progress in meeting the requirements of this order. The strategy shall include, but shall not be limited to, the following elements:

(a) A pollution prevention policy statement, developed by each Federal agency, designating principal responsibilities for development, implementation, and evaluation of the strategy. The statement shall reflect the Federal agency's commitment to incorporate pollution prevention through source reduction in facility management and acquisition, and it shall identify an individual responsible for coordinating the Federal agency's efforts in this area.

(b) A commitment to utilize pollution prevention through source reduction, where practicable, as the primary means of achieving and maintaining compliance with all applicable Federal, State, and local environmental requirements.

3-302. *Toxic Chemical Reduction Goals*. (a) The head of each Federal agency subject to this order shall ensure that the agency develops voluntary goals to reduce the agency's total releases of toxic chemicals to the environment and off-site transfers of such toxic chemicals for treatment and disposal from facilities covered by this order by 50 percent by December 31, 1999. To the maximum extent practicable, such reductions shall be achieved by implementation of source reduction practices.

(b) The baseline for measuring reductions for purposes of achieving the 50 percent reduction goal for each Federal agency shall be the first year in which releases of toxic chemicals to the environment and off-site transfers of such chemicals for treatment and disposal are publicly reported. The baseline amount as to which the 50 percent reduction goal applies shall be the aggregate amount of toxic chemicals reported in the baseline year for all of that Federal agency's facilities meeting the threshold applicability requirements set forth in section 1-102 of this order. In no event shall the baseline be later than the 1994 reporting year.

(c) Alternatively, a Federal agency may choose to achieve a 50 percent reduction goal for toxic pollutants. In such event, the Federal agency shall delineate the scope of its reduction program in the written pollution prevention strategy that is required by section 3-301 of this order. The baseline

for measuring reductions for purposes of achieving the 50 percent reduction requirement for each Federal agency shall be the first year in which releases of toxic pollutants to the environment and off-site transfers of such chemicals for treatment and disposal are publicly reported for each of that Federal agency's facilities encompassed by section 3-301. In no event shall the baseline year be later than the 1994 reporting year. The baseline amount as to which the 50 percent reduction goal applies shall be the aggregate amount of toxic pollutants reported by the agency in the baseline year. For any toxic pollutants included by the agency in determining its baseline under this section, in addition to toxic chemicals under EPCRA, the agency shall report on such toxic pollutants annually under the provisions of section 3-304 of this order, if practicable, or through an agency report that is made available to the public.

(d) The head of each Federal agency shall ensure that each of its covered facilities develops a written pollution prevention plan no later than the end of 1995, which sets forth the facility's contribution to the goal established in section 3-302(a) of this order. Federal agencies shall conduct assessments of their facilities as necessary to ensure development of such plans and of the facilities' pollution prevention programs.

3-303. Acquisition and Procurement Goals. (a) Each Federal agency shall establish a plan and goals for eliminating or reducing the unnecessary acquisition by that agency of products containing extremely hazardous substances or toxic chemicals. Similarly, each Federal agency shall establish a plan and goal for voluntarily reducing its own manufacturing, processing, and use of extremely hazardous substances and toxic chemicals. Priorities shall be developed by Federal agencies, in coordination with EPA, for implementing this section.

(b) Within 24 months of the date of this order, the Department of Defense (DOD) and the General Services Administration (GSA), and other agencies, as appropriate, shall review their agency's standardized documents, including specifications and standards, and identify opportunities to eliminate or reduce the use by their agency of extremely hazardous substances and toxic chemicals, consistent with the safety and reliability requirements of their agency mission. The EPA shall assist agencies in meeting the requirements of this section, including identifying substitutes and setting priorities for these reviews. By 1999, DOD, GSA and other affected agencies shall make all appropriate revisions to these specifications and standards.

(c) Any revisions to the Federal Acquisition Regulation (FAR) necessary to implement this order shall be made within 24 months of the date of this order.

(d) Federal agencies are encouraged to develop and test innovative pollution prevention technologies at their facilities in order to encourage the development of strong markets for such technologies. Partnerships should be encouraged between industry, Federal agencies, Government laboratories, academia, and others to assess and deploy innovative environmental technologies for domestic use and for markets abroad.

3-304. Toxics Release Inventory/Pollution Prevention Act Reporting. (a) The head of each Federal agency shall comply with the provisions set forth in section 313 of EPCRA, section 6607 of PPA, all implementing regulations, and future amendments to these authorities, in light of applicable guidance as provided by EPA.

(b) The head of each Federal agency shall comply with these provisions without regard to the Standard Industrial Classification (SIC) delineations that apply to the Federal agency's facilities, and such reports shall be for all releases, transfers, and wastes at such Federal agency's facility without regard to the SIC code of the activity leading to the release, transfer, or waste. All other existing statutory or regulatory limitations or exemptions on the application of EPCRA section 313 shall apply to the reporting requirements set forth in section 3-304(a) of this order.

(c) The first year of compliance shall be no later than for the 1994 calendar year, with reports due on or before July 1, 1995.

3-305. Emergency Planning and Community Right-to-Know Reporting Responsibilities. The head of each Federal agency shall comply with the provisions set forth in sections 301 through 312 of EPCRA, all implementing regulations, and future amendments to these authorities, in light of any applicable guidance as provided by EPA. Effective dates for compliance shall be: (a) With respect to the provisions of section 302 of EPCRA, emergency planning notification shall be made no later than 7 months after the date of this order.

(b) With respect to the provisions of section 303 of EPCRA, all information necessary for the applicable Local Emergency Planning Committee (LEPC's) to prepare or revise local Emergency Response Plans shall be provided no later than 1 year after the date of this order.

(c) To the extent that a facility is required to maintain Material Safety Data Sheets under any provisions of law or Executive order, information required under section 311 of EPCRA shall be submitted no later than 1 year after the date of this order, and the first year of compliance with section 312 shall be no later than the 1994 calendar year, with reports due on or before March 1, 1995.

(d) The provisions of section 304 of EPCRA shall be effective beginning January 1, 1994.

(e) These compliance dates are not intended to delay implementation of earlier timetables already agreed to by Federal agencies and are inapplicable to the extent they interfere with those timetables.

Sec. 4-4. Agency Coordination.

4-401. By February 1, 1994, the Administrator shall convene an Interagency Task Force composed of the Administrator, the Secretaries of Commerce, Defense, and Energy, the Administrator of General Services, the Administrator of the Office of Procurement Policy in the Office of Management and Budget, and such other agency officials as deemed appropriate based upon lists of potential participants submitted to the Administrator pursuant to this section by the agency head. Each agency head may designate other senior agency officials to act in his/her stead, where appropriate. The Task Force will assist the agency heads in the implementation of the activities required under this order.

4-402. Federal agencies subject to the requirements of this order shall submit annual progress reports to the Administrator beginning on October 1, 1995. These reports shall include a description of the progress that the agency has made in complying with all aspects of this order, including the pollution reductions requirements. This reporting requirement shall expire after the report due on October 1, 2001.

4-403. Technical Advice. Upon request and to the extent practicable, the Administrator shall provide technical advice and assistance to Federal agencies in order to foster full compliance with this order. In addition, to the extent practicable, all Federal agencies subject to this order shall provide technical assistance, if requested, to LEPC's in their development of emergency response plans and in fulfillment of their community right-to-know and risk reduction responsibilities.

4-404. Federal agencies shall place high priority on obtaining funding and resources needed for implementing all aspects of this order, including the pollution prevention strategies, plans, and assessments required by this order, by identifying, requesting, and allocating funds through line-item or direct funding requests. Federal agencies shall make such requests as required in the Federal Agency Pollution Prevention and Abatement Planning Process and through agency budget requests as outlined in Office of Management and Budget (OMB) Circulars A-106 and A-11, respectively. Federal agencies should apply, to the maximum extent practicable, a life cycle analysis and

total cost accounting principles to all projects needed to meet the requirements of this order.

4-405. Federal Government Environmental Challenge Program. The Administrator shall establish a "Federal Government Environmental Challenge Program" to recognize outstanding environmental management performance in Federal agencies and facilities. The program shall consist of two components that challenge Federal agencies: (a) to agree to a code of environmental principles to be developed by EPA, in cooperation with other agencies, that emphasizes pollution prevention, sustainable development and state-of-the-art environmental management programs, and (b) to submit applications to EPA for individual Federal agency facilities for recognition as "Model Installations." The program shall also include a means for recognizing individual Federal employees who demonstrate outstanding leadership in pollution prevention.

Sec. 5-5. Compliance.

5-501. By December 31, 1993, the head of each Federal agency shall provide the Administrator with a preliminary list of facilities that potentially meet the requirements for reporting under the threshold provisions of EPCRA, PPA, and this order.

5-502. The head of each Federal agency is responsible for ensuring that such agency take all necessary actions to prevent pollution in accordance with this order, and for that agency's compliance with the provisions of EPCRA and PPA. Compliance with EPCRA and PPA means compliance with the same substantive, procedural, and other statutory and regulatory requirements that would apply to a private person. Nothing in this order shall be construed as making the provisions of sections 325 and 326 of EPCRA applicable to any Federal agency or facility, except to the extent that such Federal agency or facility would independently be subject to such provisions. EPA shall consult with Federal agencies, if requested, to determine the applicability of this order to particular agency facilities.

5-503. Each Federal agency subject to this order shall conduct internal reviews and audits, and take such other steps, as may be necessary to monitor compliance with sections 3-304 and 3-305 of this order.

5-504. The Administrator, in consultation with the heads of Federal agencies, may conduct such reviews and inspections as may be necessary to monitor compliance with sections 3-304 and 3-305 of this order. Except as excluded under section 6-601 of this order, all Federal agencies are encouraged to cooperate fully with the efforts of the Administrator to ensure compliance with sections 3-304 and 3-305 of this order.

5-505. Federal agencies are further encouraged to comply with all state and local right-to-know and pollution prevention requirements to the extent that compliance with such laws and requirements is not otherwise already mandated.

5-506. Whenever the Administrator notifies a Federal agency that it is not in compliance with an applicable provision of this order, the Federal agency shall achieve compliance as promptly as is practicable.

5-507. The EPA shall report annually to the President on Federal agency compliance with the provisions of section 3-304 of this order.

5-508. To the extent permitted by law and unless such documentation is withheld pursuant to section 6-601 of this order, the public shall be afforded ready access to all strategies, plans, and reports required to be prepared by Federal agencies under this order by the agency preparing the strategy, plan, or report. When the reports are submitted to EPA, EPA shall compile the strategies, plans, and reports and make them publicly available as well. Federal agencies are encouraged to provide such strategies, plans, and reports to the State and local authorities where their facilities are located for an additional point of access to the public.

Sec. 6-6. Exemption.

6-601. In the interest of national security, the head of a Federal agency may request from the President an exemption from complying with the provisions of any or all aspects of this order for particular Federal agency facilities, provided that the procedures set forth in section 120(j)(1) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (42 U.S.C. 9620(j)(1)), are followed. To the maximum extent practicable, and without compromising national security, all Federal agencies shall strive to comply with the purposes, goals, and implementation steps set forth in this order.

Sec. 7-7. General Provisions.

7-701. Nothing in this order shall create any right or benefit, substantive or procedural, enforceable by a party against the United States, its agencies or instrumentalities, its officers or employees, or any other person.

William Clinton

THE WHITE HOUSE.

August 3, 1993.

[FR Doc. 93-19086
Filed 8-4-93; 4:37 pm]
Billing code 3195-01-P

APPENDIX C

Glossary

Glossary

AAPPSO	= Army Acquisition Pollution Prevention Support Office
AEC	= Army Environmental Center
AMC	= Army Materiel Command
API	= American Petroleum Institute
ASTM	= American Society for Testing and Materials
CAA	= Clean Air Act
CERCLA	= Comprehensive Environmental Response, Compensation, and Liability Act
CFCs	= chlorofluorocarbons
CHIC	= CFC/Halon Information Clearinghouse
CMA	= Chemical Manufacturers Association
CWA	= Clean Water Act
DECIM	= Defense Environmental Corporate Information Management
DERA	= Defense Environmental Restoration Account
DfE	= Design for the Environment
DLA	= Defense Logistics Agency
DRMO	= Defense Reutilization and Marketing Office
EO	= Executive order
EPA	= Environmental Protection Agency
EPCRA	= Emergency Planning and Community Right-to-Know Act
FAME	= Federal Agency Mini-Exchange
FFCA	= Federal Facilities Compliance Act of 1992

GEMI	= Global Environmental Management Initiative
GOCO	= Government-owned, contractor-operated
HAZMIN	= hazardous waste minimization
NDCEE	= National Defense Center for Environmental Excellence
NEMA	= National Electrical Manufacturers Association
NEPA	= National Environmental Policy Act
NPCA	= National Paint and Coatings Association
ODCs	= ozone-depleting chemicals
ODSs	= ozone-depleting substances
PIES	= Pollution Prevention Information Exchange System
PPA	= Pollution Prevention Act
PPIC	= Pollution Prevention Information Clearinghouse
PRIME	= Plastics Reduction in the Marine Environment
RCRA	= Resource Conservation and Recovery Act
RDT&E	= research, development, test, and evaluation
SARA	= Superfund Amendments and Reauthorization Act
SETAC	= Society of Environmental Technology and Chemistry
TIPPP	= Tidewater Interagency Pollution Prevention Program
TQEM	= Total Quality Environmental Management
TQL	= total quality leadership
TQM	= total quality management
TRI	= Toxics Release Inventory
WRAP	= Waste Reduction Always Pays

REPORT DOCUMENTATION PAGE

Form Approved
OPM No.0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering, and maintaining the data needed, and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

1. AGENCY USE ONLY (Leave Blank)		2. REPORT DATE November 1993		3. REPORT TYPE AND DATES COVERED Final	
4. TITLE AND SUBTITLE Pollution Prevention in the Department of Defense				5. FUNDING NUMBERS C MDA903-90-C-0006 PE 0902198D	
6. AUTHOR(S) Andres Talts, Christopher Werle					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Logistics Management Institute 6400 Goldsboro Road Bethesda, MD 20817-5886				8. PERFORMING ORGANIZATION REPORT NUMBER LMI- IR301R1	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Logistics Management Institute 6400 Goldsboro Road Bethesda, MD 20817-5586				10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION/AVAILABILITY STATEMENT A: Approved for public release; distribution unlimited				12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) The highly successful hazardous waste minimization programs carried out by the Military Services and Defense Agencies over the past several years have reduced hazardous waste generation by more than half. Similarly, nonhazardous solid waste management programs are well on the way to achieving significant reductions. Unfortunately, the high costs of efforts to sustain day-to-day compliance and cleanup of contamination have left little beyond "survival-level" resources available for pollution prevention initiatives, which ultimately have the greatest potential for future benefits. This report proposes positive actions to further pollution prevention as the method of choice for sustained environmental compliance and for the future direction of the overall DoD environmental program. It addresses in detail the definition of pollution prevention, provides definitive examples to illustrate its meaning, summarizes major pollution prevention initiatives within DoD and private industry, and highlights those initiatives holding the greatest promise for broad application across the DoD Components. It also provides recommendations for how DoD can strengthen its position to meet its environmental security objectives and affirm its national leadership role in pollution prevention.					
14. SUBJECT TERMS Pollution prevention				15. NUMBER OF PAGES 90	
				16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL		